approach

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Why does one aircraft hit the ramp when others do not?

Strike One, You're Out!

By LCDR R.E. Post

The Lieutenant, a fleet replacement pilot, was on his first night hop since reporting aboard the deployed A-4 squadron. He had completed a night carrier refresher period less than a month prior to this flight and had accumulated over 500 hours in the A-4. It was a moonless night with multiple cloud layers, but no precipitation.

At 2106 he called, "BIRDBATH TWO ONE departing marshall, state two point two." At 2107 CCA called, "All aircraft in RAKESHACK pattern signal delta." One turn around the delta circle and the Lieutenant proceeded inbound. On deck, another A-4 had collapsed a nose gear on landing and was lifted onto a crash dolly by the big fork lift. The flight Deck Bos'n gave the Air Boss an estimate of 30 seconds 'till "Green Deck."

"BIRDBATH TWO ONE ball, state two point zero." "In the groove, read paddles?" "Roger paddles . . ."

"Clear deck" boomed the 5 MC.

Halfway down the slope, the A-4 went "a little low." A power call was answered and the A-4 returned to an "on the slope" condition, amber approach indexer light glowing steadily. As the A-4 arrived at 300 yards astern, the approach light suddenly blinked to green and a rapid sink rate developed. The LSO responded with three increasingly frantic calls for power, then two waveoffs on the radio plus activation of the waveoff lights. The A-4 continued to rotate to an extremely nose-high attitude and continued settling until it struck the ramp and exploded. The LSO later stated that engine noise level indicated no addition of power close to the ship.

One of the old hands at the Naval Aviation Safety Center was recently heard to remark, "Only the names and bureau numbers change." He was speaking from impressions gained during several years of

reading aircraft accident reports, articles in APPROACH and other aviation safety publications. His point is well taken, if applied to ramp strikes, because the accident narrated above is a composite of several similar accidents which differ only in minor detail.

Not so long ago the carrier pilot "lived with" hazards greatly different from those he faces today.

There were wire barriers to hit if he missed the arresting pendants. There was a pack of aircraft dead ahead—sometimes armed and always fueled—if the "fences" failed. Deck lighting was poor. There was no direct-reading optical landing system, no tacan, no SPN-gear and no CCA.

In those days about the only difference between a safe arrested landing and an accident was the skilled eye of the LSO and the pilot's technique. But there were big pluses for those straight-deck pilots. First, the approach airspeeds were lower and second, the LSO's signals and reciprocating engine's rapid response in the flatter pass prevented most ramp strikes; Jet pilots were given cut signals and had to "plant it" between the ramp and the first barrier.

But the skilled eye of the LSO. . .

Angle deck and lens have replaced. . .

Fences and Paddles. . .

Today the barriers are gone, and many improvements have been made in carrier landing safety. The most effective devices to prevent ramp strikes, however, remain the same as in the old days—sound LSO and pilot techniques!

The Problem

Five years ago the Navy had 34 ramp strikes in a single year—almost three per month. In fiscal year 1965 there were only 20. In fiscal year 1960, 34 ramp strikes cost the Navy $11,842,700 whereas in fiscal year 1965 the cost of 20 ramp strikes was well over $16 million.

Between 1 July 1959 and 1 July 1965 37 people were killed and 38 injured in ramp strikes. During this period, 177 aircraft were damaged as a result of 163 ramp strikes. Of these, 63 were strikes while the remaining 114 were eventually returned to service. The price tag, excluding the inestimable and irreplaceable loss of personnel, totaled $104,473,000! The problem is obvious; the solution, less obvious.

It is likely that every carrier aviator and every LSO has a pet theory on why ramp strikes occur and an opinion of how they can be prevented. Many words have been written on the subject. Words will not prevent ramp strikes, but a pilot who has *the* word, and is acquainted with most of the known facts, is better equipped to avoid them.

Pilots and LSOs prove more than 20,000 times every month that *ramp strikes can be avoided.*

Many questions arose in the exploration of the ramp strike problem in preparation of this article.

Most have come up in previous studies, and many have been answered in various ways.

Below are listed several of the questions considered most likely to result in constructive information, and the answers to them from the best information available.

Q. What kind of pilot has a ramp strike?

A. In the 20 ramp strikes in Fiscal 1965, pilots ages ranged from 23 to 34, averaging 28. Total pilot flight hours varied from just over 400 to more than 3000; total carrier landings ranged from fewer than 30 to more than 300. Pilots' ratings by their COs and the LSOs ranged from "very weak" to "outstanding." *It is probable that such was the case in the 300 or so other pilots who got aboard safely in the same recovery periods in which the ramp strikes occurred.*

Q. What about pilots' condition and mental preparation for the flight?

A. Physical condition and mental preparation are interrelated and are influenced by many factors. In a very few cases, of 163 ramp strike mishaps reviewed, pilots had complained of sore throats, headaches, or other minor ailments. *It is also strongly suspected that several times as many pilots were suffering similar afflictions on the same days and nights, yet had no ramp strike.* In one case a flight surgeon mentioned that the pilot had expressed apprehension about a night carrier landing. So would many good carrier aviators, if asked for a candid opinion.

In other cases, there were distinctive distracting influences, such as a low oxygen supply, a malfunctioning radio, an amber warning light at a critical moment, or a malfunctioning air conditioning system. As grave as these distractions may have been, pilots have encountered worse, such as combat wounds, flak-perforated wings or other combat-induced handicaps, and still have overcome them to make successful carrier landings.

Q. What environmental factors tend to increase the likelihood of ramp strikes?

A. *GETABOARDITIS* is probably the primary factor. It is usually accompanied by a failure to adhere to the rules learned in FMLP, such as "Do not reduce power or make large corrections in close." *DARKNESS* runs a close second, because 3 out of every 4 ramp strikes occur at night. This aspect will be discussed more fully later on. *PITCHING DECK* was listed as a factor in only 24 of 163 ramp strikes, a ratio of 1 to 6, but it cannot be discounted as an influence for it is a psychological factor that increases *getaboarditis* and makes the approach more difficult.

Q. Is low fuel state a factor?

A. A qualified "no." More than 60 ramp strike

And Pilots who have the word. . .

Still make the difference. . .

Between ramp strike and OK 3.

AARs were reviewed in their entirety and in no case was the airplane involved within *four* carrier passes (VFR-type) of fuel exhaustion, within a pass or two of "Rig the barricade" fuel state or below "Bingo" fuel. When it is considered that carriers sometimes operate hundreds of miles from an airfield, this is not surprising. In fact, of the 163 ramp strike mishaps between 1 July 1959 and 1 July 1965, *98* occurred on the pilots' *first* pass, 34 on the second pass, 18 on the third, 6 on the fourth, 2 on the fifth, 4 on the sixth, zero on the seventh or eighth and 1 on the ninth. The pilot's concern over low-fuel state can lead to a severe attack of *getaboarditis*, but should not, in view of the statistical evidence.

Q. Do most ramp strikes occur on carrier qualification landings?

A. By numbers, "no." By percentage, perhaps. During the subject period, 44 ramp strikes occurred on carqual landings. The remaining 119 ramp strikes were in air wing group operations and "build-ups."

Q. What airplane models have the highest ramp-strike rates?

A. The ramp strike rate shows approximately the same pattern as other types of carrier landing accidents (i.e. in-flight engagements, high sink rate, nose wheel first) and is proportional to the airplane approach speed. Figure 1 portrays this graphically.

Q. Do illusions play a part in ramp strikes?

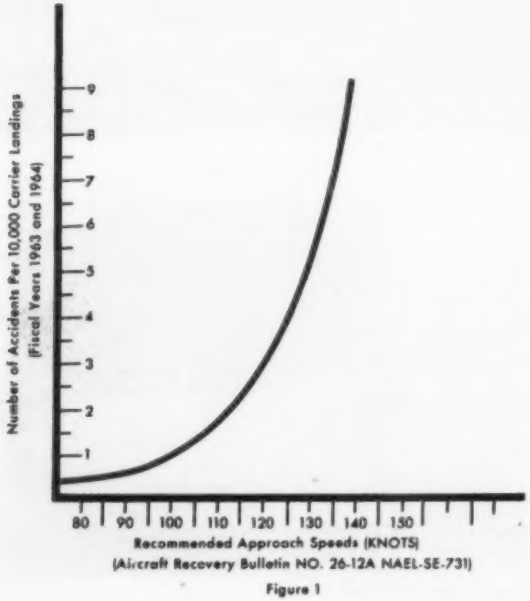


Figure 1

A. Very definitely. This is borne out by the fact that a large proportion of ramp strikes occur during hours of darkness. Darkness "shrinks" the landing area, creating the illusion of being higher than actual altitude. In addition, precipitation refracts light rays, and may add to the illusion of greater height. The illusion of being high usually results in decreasing altitude and reducing power. This can coincide with a need for *more* power and altitude, as when passing through the turbulent air flow near the ramp.

Darkness, as well as low visibility from precipitation and/or fog, removes a primary visual clue to attitude—the horizon—and the pilot must resort to the deck lighting and instruments for this clue. Darkness also removes another visual sensation readily apparent in daylight—closure rate. What this boils down to is that the pilot on a night carrier approach must adapt to a VFR approach in essentially IFR conditions. He must ignore the illusions and fly the meatball, centerline and AOA. The pilot who "spots it and goes for it" by day is SOL at night.

Q. What can be done to improve the pilot's chances of making a good carrier approach?

A. There are several things that might be done. The most expedient one is to inform pilots of the pitfalls and how they can be avoided, through frequent LSOs' lectures and by proper training on the field. Anything that can make it easier for the pilot is a step in the right direction. APC has helped and as it reaches the fleet in more airplanes, will help more pilots. The 3-mode SPN-10 is nearing fleet introduction. White deck lighting is a promising improvement that has been approved for fleet use.

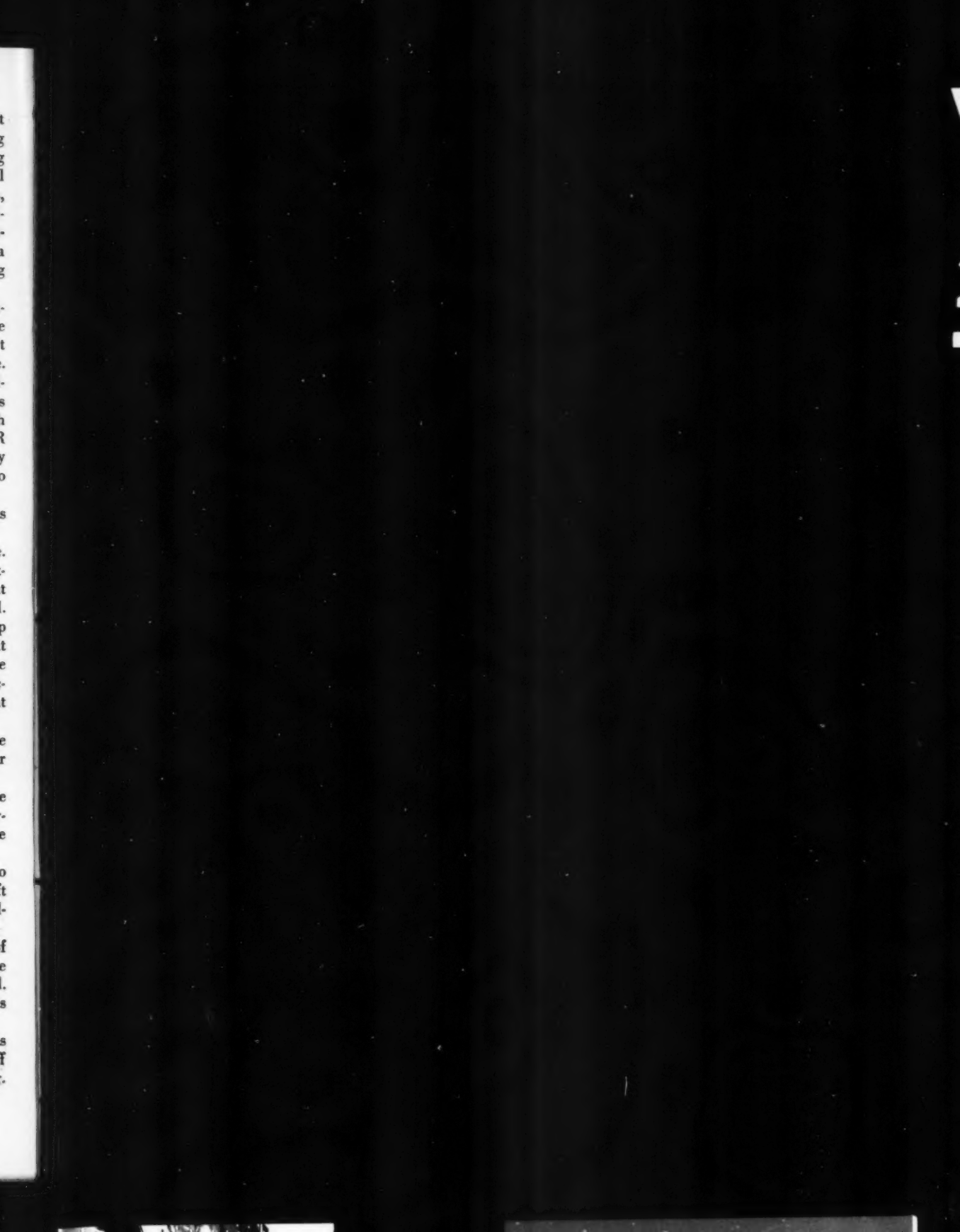
Cockpit instrumentation improvements toward the F-111B "heads up" presentation are under study for other aircraft.

The discussion above has been presented for one reason—to better acquaint pilots flying today's airplanes aboard today's carriers with the ramp strike problem.

No experience level of carrier pilot is immune to ramp strikes by virtue of his training, or the aircraft that he flies. But all can avoid ramp strikes by adhering to sound rules.

- *Start* the approach set up on airspeed/angle of attack, at the right altitude and start down when the glide slope center, not just the meatball, is intercepted.
- *Trim* the airplane for the speed at which it is flying, and make small, prompt corrections.
- Don't reduce power or make major corrections in close. If either appears necessary, wave it off or put that angled deck to its intended use—bolter.

Happy OK-3s!



Spot The Hazard

In each of these photos there is a hazard which was spotted by the pilot on his preflight inspection. As one Aviation Safety Officer wrote, 'If you find something unsafe, get a picture of it and distribute a few to the troops in the squadron. It does wonders for a safety program.'

A large socket wrench was "temporarily" placed in the starboard wheel well of a WC-121N during a 30-hour check. Not only did the user forget this wrench, but during a preflight inspection the following morning, two people failed to note its presence. The aircraft commander found the wrench during his walk around.

Yesterday, you saw this Crusader's nav light. The plane captain had flashed it into the cockpit and was called to help on a wing walker for another aircraft. He placed his flashlight in the intake duct, then forgot about it. The pilot found the flashlight on his preflight.

A-4 pilots should have spotted the intercostal brake line (just aft the pilot involved did!). If the aircraft had been flown, the brake line probably would have parted when the strut extended. Also, the landing gear handle may not have come up properly due to the nut-cracker switch failing to be activated.

THE NEW BOSS

Adapted from PACAF "Flyer"

The new boss came in before the old boss rotated. He didn't say much those first weeks . . . seemed to listen to the bull sessions, had a few good flying tales of his own. He did a fair amount of browsing through the old records and asked a lot of questions about operations, which one or another tried to answer but, somehow, we didn't agree on who really knew. Also he managed to fly with each of the crews on one trip or another.

Then one day we went to see the old boss rotate to the "Land of the Big BX" and since it was too early to go home and too late to get any work done, the new boss (he let his friends call him by his nickname, "Major") steered us to the O'Club and to a big table back in a corner.

I don't remember exactly how we worked into the

topic. I think he said SOP No. 1 would be that none of our pilots was allowed to lose a roll of the dice to a TDY troop, and SOP No. 2 was that he wasn't allowed to lose to anyone. "And speaking of SOPs, what do you guys think of . . . ?"

I can't remember the exact conversation, but after several answers he said, "Well, I know why you don't have any written SOPs in the file. None of you can agree on how to do any one thing the same way. (Pass the beer). See what I mean: one guy wants to slide it, another wants to kick it and another says, 'reach it yourself.'" And then he got down to brass tacks and let us know in no uncertain terms how he felt about standardization in Southeast Asia.

"My short period of observation indicates to me that standardization here in Southeast Asia is more important than ever before. You will ask why, since we are faced with combat circumstances and a rapidly changing situation and environment. It is just for those reasons that we must pay strict attention to safe standards and correct ways of operating.

"Of foremost significance to American flyers is the fact that in almost every facet of each operation we are training, and setting an example for, our allies, the Vietnamese.

"From the minute we start engines and call for taxi—takeoff instructions, to the time we call for post landing taxi guidance, we are setting an example for the Vietnamese who are desperately trying to learn correct procedures in the face of the most difficult obstacles.

"What confusion we must cause in the face of the language barrier if we do not file correctly, do not listen intently to clearance instructions, do not use standard R/T language, and do not speak in a clear, concise voice. What difficulties we present to the learning Air Traffic Controller if we do not adhere to flight plans and altitudes. And what hardships we heap on GCA operator trainees if we are not precise in flying instrument approaches. Just picture the 'bucket of worms' we present to the trainees across the spectrum of flying activities if each American flyer acts differently. Therefore, strict adherence to standardization, down to the finest detail, is an absolute must if we are to help our friends establish a safe, efficient air operation.

"Most of us here have come from stateside organizations where standardization, frequent checks, reliable communication/navigation facilities, and efficient, well equipped traffic control agencies are taken for granted. Many of us have never flown in any other environment and we do not realize how much protection we are afforded by our stateside systems. Since we do not have such a high degree of personal protection from trouble here, it is imperative that we be more alert to the fine details and safe procedures in our operations.

"To help us overcome the natural human tendency toward laxity and complacency, we must have a standardization/evaluation program to weld our fliers from many different commands, and with widely varying backgrounds, into efficient, safe, flying organizations in a minimum of time. A well organized orientation and checkout program serves to warn us against, and prepare us for, the many hazards encountered here which are nonexistent or at a minimum in the states.

"For example, I have already learned that one must copy carefully each IFR clearance and check it closely against the filed route and minimum altitude. The language difficulty and inexperience of many controllers makes attention to details imperative. The questionable reliability of navigational aids makes it doubly important for us to cross-check every available aid—to include pilotage when possible. In multi-place aircraft, every rated crew member must pay close attention to positions, altitudes, and terrain features. The difficulty of survival and rescue in the area lends impetus to such alertness.

"The scarcity of suitable and well supplied landing fields makes it ever more important that we know emergency procedures and techniques to the letter. An emergency landing with no flaps on a 3000-foot strip will come as a rude shock to one who avoided short field practice because a 10,000-foot runway was always available in the states. When one is accustomed to having a suitable landing place every few miles, fuel and power conservation fail to achieve the significance that is gained when suitable fields are hundreds of miles apart and separated by water or dense mountainous jungle.

"I could mention many more examples of why standardization and evaluation are so important to keeping us on our toes in our present environment. However, I hope I've said enough to illustrate my point. To sum it all up—an effective stan/eval program, within the limits of our resources, will go a long way towards helping us to train our friends and accomplish our missions. In a personal and perhaps selfish sense, it adds a big plus sign in favor of our safe completion of this tour and return to our loved ones at home."

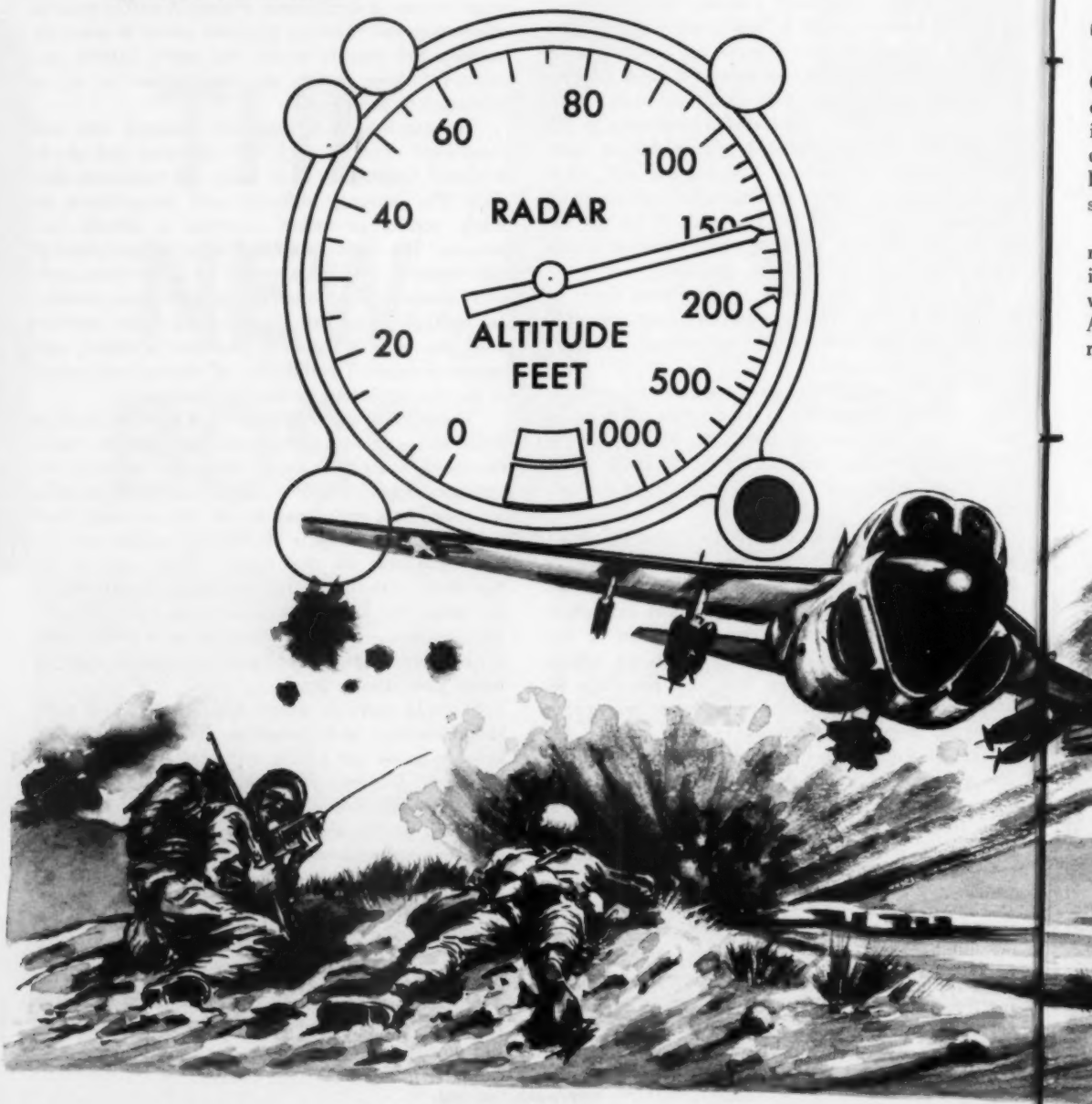
For just a moment we sat there; none of us spoke. Then, as if we had long been standardized in the act, we stood to give a toast to our new boss. SOP No. 2 is now in effect!

RAWS:

Radar Altimeter Warning System

So Engrossed With Tactical Sit
Altitude Warning Light...

By LCDR J. B. McDaniel



ical Situations, Pilots Sometimes Fail to Respond to the Red Low

The VS squadron was beginning the second day of its ORI, with flight operations commencing at 0345 local. The first flight, consisting of two groups of three S-2s each, was to depart NAS Eastcoast independently and proceed to the assigned submarine operating area approximately 130 miles south. ASW localization exercises were to be conducted with two submarines located 15 miles apart.

A thorough final brief, conducted at 0245 on the morning of the flight, brought the group leaders and individual PPC's up to date on current sea state, weather, assigned frequencies, and a host of other ASW related items. Safety precautions and exercise rules were again stressed by the briefing officer.

The takeoff at 0345 and flight to the operating area was uneventful, with group No. 1 arriving on station at 0445. The group leader established radio contact with the assigned submarine and upon rendezvous relayed instructions for the conduct of the exercise. COMEX was at 0455. Lead then descended to the minimum night operations altitude of 300 ft, marked datum with a long burning smoke light and retired. About five minutes later he returned to datum, got an immediate MAD contact, and commenced dropping additional marking flares as he entered a cloverleaf tracking pattern. After completing the second 270-degree left turn a third MADMAN was recorded. Lead was now entering the kill phase of the problem. As he attempted to level the wings momentarily, the *Tracker* experienced a severe roll further to the left to some 60-80 degrees of bank.

At this point the copilot got on the controls to assist in the recovery. Cockpit confusion reigned and with it came disaster. Even as the wings approached a normal attitude, fixation of both pilots on the single objective of righting the wings allowed the rate of descent to bottom out, resulting in the aircraft impacting the water nose down, still in a slight left bank.

Emergency distress signals dropped by sister aircraft were effective in alerting the sub skipper, who hurriedly surfaced and picked up the three survivors of the four-man crew.

This accident was attributed solely to pilot error, but was it? Was the pilot's attention saturated by the pressure of the tactical situation or was the lack of correct assistance by the copilot in monitoring the gages also a contributing factor? Probably they all were.

ASW localization is one of the most complex and demanding man-machine relationships in our modern Navy. When total instrument conditions coupled with night operations are encountered and the tactical situation is pressed to the attack phase at 300 ft, the pilot should have every altitude safety warning device available at his disposal.

Because of just such accidents and incidents, NASC

The aural warning sounded as the S-2 approached datum. . .

has pushed for quicker development, wider adoption and utilization of the Radar Altimeter Warning System (RAWS).

The radar altimeter system is of prime importance to the ASW plane commander and upon localization becomes an integral part of the primary instrument scan pattern. For those of us who have and continue to operate in the ASW air picture many safety devices have been added that contribute greatly to the overall mission as well as safety. The AFCS (Automatic Flight Control System) currently utilized by most ASW types is a boon to the field. However, one of the integral sensors and inputs to the AFCS, the radar altimeter, is still subject to failure and does fail quite frequently when needed most. Flight is certainly not impossible without it but its absence greatly increases the plane commander's work load and becomes just another distraction factor.

The P-3, one of our most modern ASW aircraft, is in need of an added component to its present AFCS package—RAWS.

The RAWS installation is not a panacea to prevent a flight from terminating in an inadvertent collision with the surface during low-level operations. RAWS will only provide the pilots with an actual warning that the aircraft is below a safe, preprogrammed altitude for its profile of operations.

We have briefly covered the ASW picture, to which an entire book could be devoted. Now let's take a look at the jet set and some of their areas of concern. The AFCS is not restricted to the heavies; on the contrary, many of the light attack drivers and VF types enjoy the advantages of such a system.

Before we consider RAWS for the jet types—is there a need? Does their mission profile define the requirement? The answer is an emphatic *yes*, as illustrated by the following.

Shortly after an 0830 brief the A-6 pilot and his B/N proceeded to the line shack to check the yellow sheets. The pilot noted that the Pressure Altimeter had been griped for sticking and that the radar altimeter was not installed, and then signed for the aircraft. Subsequent preflight, start, weapons systems checks and taxi were accomplished in a normal manner. Takeoff was at 0945.

Execution of the assigned mission went smoothly just as briefed until the final portion of the leg between Pt Bravo and Hook Point.

The B/N had Hook Point on the radar and so informed the pilot who then shifted his scan from visual to radar. After descending to an altitude of 200 ft the pilot initiated a slight right turn to correct for proper track. Instrument scan was now interrupted and the vertical speed indicator became the forgotten gage. All the symptoms of scan breakdown were now evident as the altimeter began to unwind and the IAS began to increase. As the altitude dissipation continued both the pilot and the B/N were caught up in the tactical application of their machine.

The mental alarm went off for both occupants simultaneously as the altitude rapidly approached ZERO. Each looked up, looked out and experienced the sickening realization that impact with water was imminent. There had been no sensation of an unusual attitude or gradual loss of altitude, only the sudden impact with the water.

Contact with the water was in a flat attitude and was estimated to have occurred at 310 kts with a 5 to 6-G impact force. As the A-6 bounced back into the air the pilot immediately pulled back on the stick to no avail. At this time the A-6 had ceased to respond as an aircraft. Both throttles were frozen, severe airframe vibrations began, and complete electrical failure occurred. The situation deteriorated still further when all internal and external communications were lost.

The aircraft now had assumed a ballistic trajectory —the pilot, unable to utilize the ICS gave the B/N a clenched fist, thumbs up—the signal for him to eject. (*Note—Although not IAW NATOPS for the A-6, OpNavInst P3710.7C defines this as a "gear up" signal.—Ed.*) The B/N immediately ejected and the pilot followed seconds later. Both ejection sequences and nylon descents were smooth and as advertised by Martin-Baker.

Approximately 20 minutes after water entry they

were rescued by a civilian fishing crew which had witnessed the accident.

Through the teaching mechanisms of retrospect and introspection we learn many of our own personal shortcomings and those of the machine which we operate. Considering the A-6 pilot's actions we can draw some conclusions similar to the investigation board. Primary error was directly attributable to the pilot and rightly so. Upon close analysis, however, many contributing factors came to light. Accepting the A-6 for a low level flight (or for that matter offering the bird for certain mission profiles if you are the maintenance officer) with "flyable" discrepancies that in reality could contribute to the loss of the aircraft if circumstances are just right, is unthinkable. Case in point: this A-6 which had a previous gripe on the pressure altimeter counter pointer (it hung up and lagged during descents) was still accepted by the pilot even though he knew *the radar altimeter was physically removed from the aircraft for repair.*

On extended low level flights, particularly over water, out of radio contact with your friendly FSS, the local altimeter setting is generally not too accurate. As all pilots remember from the annual instrument quizzes, "When flying from high to a low, the pressure altimeter reads high but you are actually low" and also conversely true. The lessons to be learned from this—lads—mistakes are merely repetitious of those made by pilots, now statistics.

This needless loss of an A-6 perhaps could have been prevented, all other factors duly considered by:

- Not accepting the gripe write-off on the pressure altimeter malfunction.

RAWS is not a panacea to prevent a flight from terminating in an inadvertent collision with the surface.

• Insisting that the radar altimeter be installed, particularly for this low-level simulated intrusion profile.

• Having the radar aural warning system installed, not pending as an airframe change.

The total cost of the RAWS installation hardware as a change kit for *all* the aircraft that can utilize the system does not equal the cost of the A-6 that was lost.

The benefits that RAWS will provide when finally integrated into Navy AFCS/Radar Altimeter equipped aircraft are many fold. RAWS, as an airborne electronics device, was designed to enhance the in-flight safety of rotary and fixed winged aircraft by warning the pilot and copilot when certain critical aircraft radar altimeter conditions occur. The warning provided is a distinctive 1000 cps audio tone in the pilot's and copilot's headset, synchronized with a flashing indicator lamp on the aircraft instrument panel. The following general conditions will activate the warning device when:

• The aircraft is flying at critically low altitudes.

• The radar altimeter circuitry indicates unreliability or failure.

• The input power to the radar altimeter has failed.

In detail, RAWS will produce a warning (either visual/audio or both) when any one of the following conditions exist during ASW maneuvers:

• High altitude warning—three second warning whenever aircraft descends through the preset high altitude index which is internally adjustable for altitudes from 100 to 500 ft. Purpose of this warning is to provide a preliminary indication that aircraft is *approaching* a dangerously low altitude.

• Low altitude warning—continuous warning bursts whenever aircraft descends through and remains below the preset low altitude index which is internally adjustable for altitudes from 8 or 25 ft to 300 ft. UH-2 helicopters, only, use the "bug" switch on the radar altimeter indicator to adjust the low altitude index. Purpose of the low altitude warning is to provide a warning that the aircraft is *at* a dangererously low altitude.

• Unreliability of radar signal or failure of radar altimeter circuitry—continuous warning bursts whenever radar altimeter is in unreliable mode (except above max range of radar altimeter) or radar altimeter reliability circuit has failed. Warning will also be activated if aircraft is below 900 ft and maneuvers in a steep bank or turn such that insufficient radar return causes radar altimeter to temporarily become unreliable.

• Power failure—continuous warning bursts if an AC or DC power failure occurs in the radar altimeter.

Some of the warning modes described above can and will be inhibited (prevented) on certain aircraft and associated equipment conditions. All wheels down and locked will inhibit the following warnings:

• Unreliable radar altimeter.

• Low altitude (audio only).

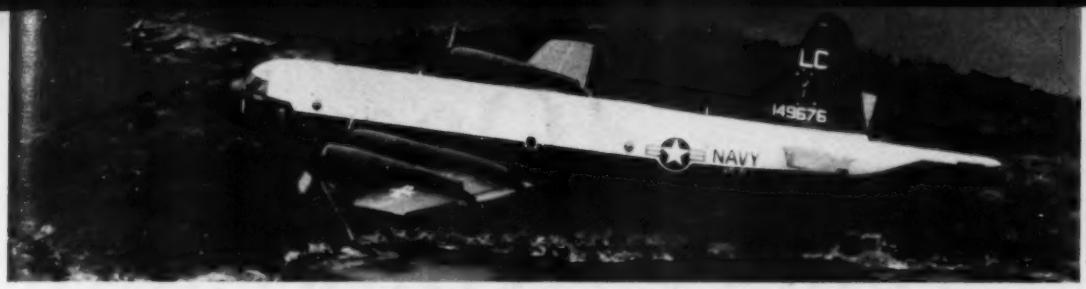
• High altitude (in some installations).

In the SH-3A helos for instance, the three-second high altitude warning will be inhibited when the ASE coupler is engaged. The purpose of this inhibit is to prevent the high alt warning when descending into the hover position. A weight-on-wheels signal will inhibit the audio portion of the warning generated if the radar altimeter is OFF while on the deck or ground except when the RAWS self test button is depressed. The inhibit modes in the P-3A aircraft are unlike those in other aircraft in that instead of "wheels down" as a basic inhibit mode the "flaps down" condition is used to inhibit all warnings under any condition except for selt-test feature.

The remaining inhibit mode concerns only those operations above a barometric altitude of 700± 200 ft referenced to takeoff altitude. This inhibit will be valid *only* when two conditions exist: (1) the barometric altitude is greater than 700± 200 ft and (2) the radar altimeter is unreliable (pointer behind the mask). The extent of the inhibit is such that it will prevent all warnings except those generated due to a power failure in the radar altimeter since the power failure condition overrides all inhibiting inputs. The barometric altitude information mentioned above, is obtained from a barometric switch in the RAWS. The baro switch is a differential pressure type which automatically receives a sample of reference pressure when power is initially applied to the RAWS and then actuates at an altitude of 700± 200 ft above the reference altitude. The primary function of the baro switch is to inhibit those warnings which would be generated at an altitude greater than the max range of the radar altimeter.

With a basic knowledge of what the RAWS can do, let us discuss some of the RAWS operational characteristics; such as, what is available to the pilot and what, if any, unusual phenomena might be expected. First of all, there is no ON/OFF switch for the warning set since it is inflight safety equipment.

The intent here is to provide maximum security for the pilot and aircraft. Secondly, a self-test feature is provided which enables the pilot to check the RAWS during preflight and also during flight. A



Any radar altimeter failure will generate an aural warning.

push-button switch is provided in the cockpit area which will activate the audio and visual warnings when the switch is depressed. If desired to test the RAWS when flying above the reliable range of the radar altimeter, the self-test switch must be depressed for a three-to-nine-second interval before the warning occurs. The exact interval of the delay will depend upon the setting of the reliability delayer circuit in RAWS. As a third operational characteristic, the baro switch may be re-referenced during flight by removing it. The only time it would be desirable to re-reference the switch is if it is known that the barometric pressure at the particular aircraft location is more than 200 ft different than the pressure at the takeoff area. The re-referencing should occur at an altitude of 100 ft or preferably less, depending on what the mission permits.

There is one peculiar situation which may occur between 1000 and 2000 ft during the ASW mission with AN/APN-117 radar altimeter. The APN-117 gives reliable altitude indications up to approximately 1200 ft. When the radar altimeter receives insufficient signal return, the indicator pointer should go behind the mask and remain there until a reliable signal is received. However, above 1200 ft the pointer goes behind the mask but continues to move into the low altitude region, indicating as high as a 60 ft. The phenomenon is referred to as "cycling." While this is happening, the radar output signals are exactly the same as would be generated at true low altitudes. RAWS sees what it thinks is a low altitude condition and emits a warning. As soon as the radar altimeter return signal becomes unreliable, the pointer will snap behind the indicator mask and the RAWS warnings are inhibited by its internal circuitry. As the aircraft continues to climb after this initial radar altimeter "cycle" the radar altimeter will continue to cycle while in the range of 1200 to 2000 ft RAWS contains circuitry to reject the information in these succeeding "cycles." It is only during the initial "cycle" that spurious warnings are generated. However, if the aircraft alternates between 1200 ft and 2000 ft, RAWS will generate a series of warnings (2 to 6 beeps probably) each time the radar altimeter first cycles. Above 2000 ft the radar altimeter indicator will remain behind the mask indicating a true unreliable condition. Warnings are inhibited until the radar altimeter actually goes back to a reliable indication.

With the aircraft resting on the deck (or ground) and the power busses energized, a visual warning will be obtained (except in the P-3A and SH-3A aircraft). To obtain a self-check on the RAWS depress the RAWS test button and both the audio and visual warnings will be present. Upon launch the visual warnings will continue (except in the P-3A) until the aircraft is above the low altitude warning setting. If the wheels should be pulled up prior to climbing through the low altitude warning setting, both visual and audio warnings will be obtained until above that setting. If the aircraft continues to climb and the radar altimeter is functioning properly, no further warnings will be obtained until the radar altimeter initially cycles (at about 1200 ft if the radar altimeter is an APN-117). Upon descent and with the radar altimeter functioning properly, a three-second warning will be generated when passing through the high altitude setting (except in a SH-3A with the coupler engaged). Upon further descent continuous audio and visual warnings will be obtained when descending through and remaining below the low altitude warning setting. If the wheels are down and locked when this occurs, only the visual warning will be obtained. In the P-3A aircraft the audio and visual warning will be initiated when below the low altitude warning except when the flaps are down. In all aircraft except the P-3A and the SH-3A the visual warning will continue after landing.

The warnings described in the preceding paragraph should normally occur during an ASW mission. Any radar altimeter failure or irregular aircraft maneuver during a mission would generate warnings for reasons other than those described above.

RAWS will not in itself prevent accidents but will provide one more safety device to assist the pilot.

(Ed Note—Technical data in this article is based on the minutes of the ComFAirSDiego RAWS conference held in March 1966.)

Operations Safety Symposium

LTJG Stephen G. Gross, VS-34

What do summer rotations, post deployment leaves, and Christmas vacation periods have in common? Such times seem to generate a host of factors that may reduce pilot proficiency and maintenance capability. Here's how one squadron handles such a situation.

Pilots who are away from their planes, for the myriad reasons that seem to arise every Christmas season and during post-deployment periods, lose proficiency not only in basic flying ability but also in the emergency procedures and survival knowledge they must, as professional aviators, possess.

Squadron commanding officers, executive officers, operations officers, safety officers, and *pilots* have spent long hours pondering the safety-of-flight problems that arise from extended periods on the ground, and many solutions have been suggested. So far the most practical solution for the mechanics of handling an airplane is that used for students in the training command: the warm-up. The SNA who is grounded or on leave for a long period is given "free" hops to regain the feeling for his airplane. This procedure works on the fleet level too.

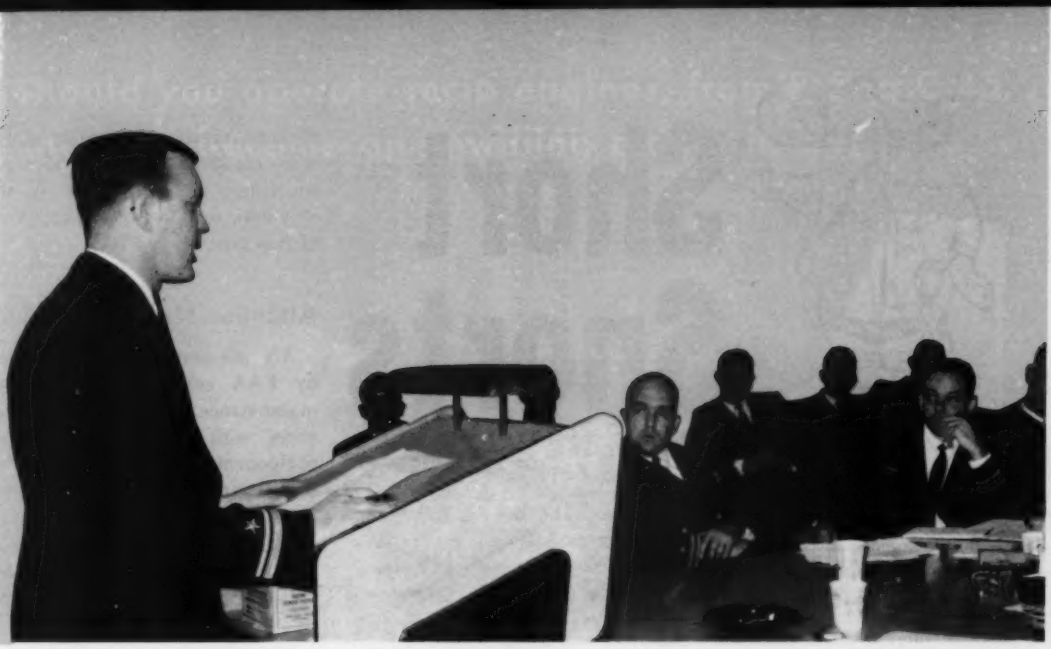
After two weeks' leave it's nice to spend a couple of hours at 5000 ft before taking on that hot datum at a hundred. The simple procedure of scheduling a warm-up may raise lost proficiency enough to prevent an accident or incident. (Also good for co-pilots who have been out of the left seat for a long time.)

You have to refresh bookwork. You have to fight complacency and you have to relearn headwork. An accident investigation is no time to discover this.

As the year came to an end the schedule for our VS squadron looked easy. With the Christmas leave period extending into mid-January; the ship scheduled for a six-month yard period; a detachment to another CVS for a short cruise; and a short deployment to an air station in the Caribbean, there was a 3-month period of relative inactivity to be wary of.

The Christmas leave period would result in a loss of pilot proficiency. With the ship in the yard there would be a substantial loss of squadron proficiency in carrier operations. By sending a detachment to another CVS, the squadron, split into two independent groups, would suffer a serious loss of standardization. To fill this recognized need and partially solve the problems presented by this schedule, the Squadron Safety Symposium was evolved. In a letter to all squadron officers, the commanding officer said:

"As a squadron we have passed the midpoint of the competitive fiscal year with a steadily increasing level of readiness and a flying safety record which is a credit to the professionalism of all of you. Despite this record, which might delude us into thinking too well of ourselves, now is the time for a redoubled effort to review all areas of aviation safety as they apply to VS flying, to attempt to sort out the significant from the relatively unimportant, and to separate the real and potential problems from the forest of facts and figures which clutter the official environment of every 1966 Naval Aviator. Now is the time to step ahead of the problems which confront us in a continued campaign to attain the highest level of readiness and safety, and at the same time to develop in all of us attitudes, professional discipline and habits which will enhance long and productive contributions to naval aviation."



A formal conference would be held with each of the officers spending an entire day immersed in the problems of aviation safety; not only attending but actively participating by speaking on a topic relative to aviation safety. The S-2 analyst from the Naval Aviation Safety Center was scheduled as a guest speaker. The letter closed:

". . . Speakers are encouraged to apply a serious effort and careful attention to the preparation of assigned topics in order to assure that worthwhile and lasting benefit is derived from the symposium. Aviation safety in the Navy, in this command, on your flight, begins with you."

The symposium ran like a hit Broadway play. At 0900 the executive officer called the symposium to order and introduced the commanding officer who set the mood of the meeting with a restatement of the command safety policy and a redefinition of the squadron's goals. For three hours of the morning session the officers listened to talks that covered the entire field of aviation safety: Little known items on their poopy suits, the safety publications available to them, what to look for on the line and the proper use of yellow equipment. They heard about cold weather operations from the training officer, just back from a two-year tour in Antarctica and an expert in cold-weather flying. They learned the real importance of physical condition from the administrative officer, a one-time all-Navy basketball player. They reviewed the do's and don'ts of radio communication. By 1200 there was not an officer in the conference room who had not learned something from the morning's activities.

After lunch, as the officers enjoyed their coffee, the NASC analyst spoke. Using films of recent S-2 accidents to illustrate and amplify his points he hammered home the importance of standardization and NATOPS in the prevention of aircraft accidents. The pilots were so impressed with what the guest had to say that they asked many questions after he had finished his presentation.

During the afternoon session there were 11 speeches covering everything from single-engine operations to the proper procedures for leading a flight of airplanes. The formal symposium ended at 1630 but the safety discussion was far from over. It continued that day and in the days that followed.

Nor has it ended yet. The safety symposium revitalized and reemphasized the importance of aviation safety for all the squadron officers. It has given a renewed awareness of the importance of safety on all levels of aircraft responsibility. The work involved in preparing a speech made each officer something of an expert on his subject and the knowledge gained from that research has tended to lead to the accumulation of more or better knowledge. That continuing quest has led to continuing informal discussions. The Safety Officer no longer stands alone at AOMs talking safety—everyone gets into the act now. This is what the Safety Symposium did for us. It may not do the same for you, but then it may. We recommend it highly . . .

Short Snorts

Rough Stuff

Since communications with the local center were poor, the pilot of an A-3 had had to rely exclusively on aircraft radar to avoid the widely scattered storm cells along his route. He was proceeding west on J-90 at FL 200 when the aircraft entered a light-colored cloud which appeared to be well outside the nearest storm cell.

Shortly after entering the cloud, light precipitation was encountered. It soon became heavy, and was followed by hail about the size of marbles. As intensity of the hail increased, the nose radome could be heard cracking and deteriorating. Finally it disintegrated and carried away. Shortly after this occurred, the aircraft broke out into the clear and the pilot proceeded VFR to an alternate field at a reduced speed to lessen buffeting.

During the approach and landing at the alternate field, the pilot of a local T-33 aircraft provided airspeed and angle of attack information, two items which were lost when the radome disintegrated (see photo at right).

The pilot stated that turbulence was light in the storm, even while penetrating the area of heavy precipitation and hail.

Thunderstorm penetration is an old problem and continues to give headaches. The use of radar for storm cell avoidance is a very useful tool, but does not always completely eliminate the problem. In some instances radar does not give adequate information on hail or turbulence areas.

Since it is not operationally feasible to keep aircraft on the ground every time a squall line or thunderstorms appear along the proposed flight route, professionalism and good judgment are the most important tools available to a pilot in this situation.

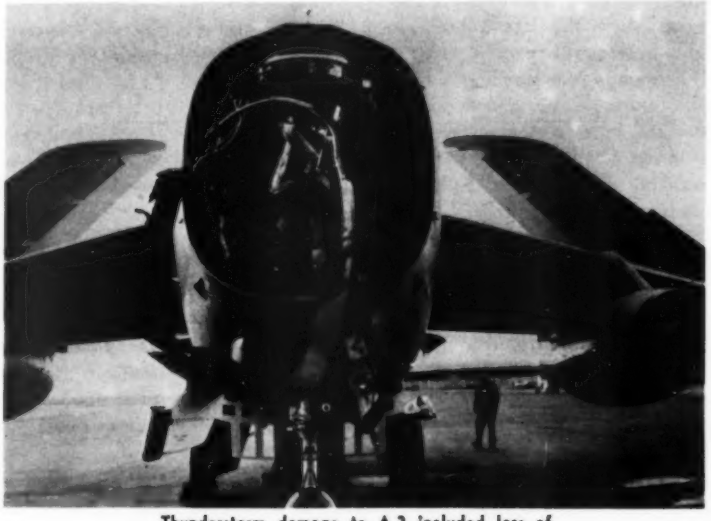
Although higher altitudes (FL 300 to FL 350) usually facilitate circumnavigation of major storm cells, complete avoidance of areas containing thunderstorms is the only sure way to prevent incidents of this type.

Attention Navy Aero Clubs

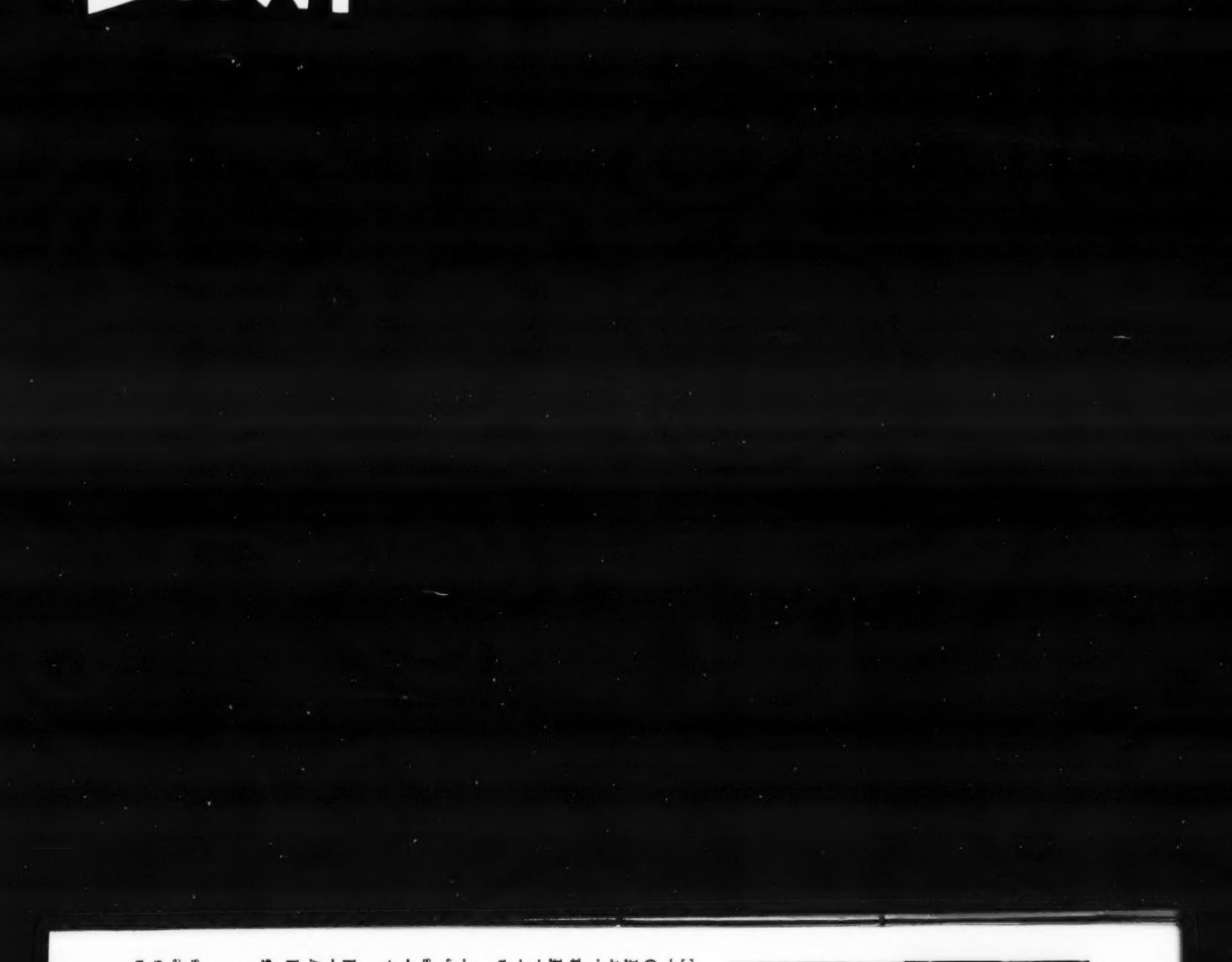
AN advisory circular compiled by FAA covering unsatisfactory maintenance and material experiences with civilian aircraft and components is now available.

The circular, part of the agency's general aviation safety program, includes voluntary reports on airframes, engines, accessories, maintenance notes and special notices.

The General Aviation Inspection Aids, published monthly and summarized annually, may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, D. C. 20402. A check or money order payable to the Superintendent of Documents in the amount of $1.50 ($2.00 foreign mailing) should accompany an order for FAA AC No. 20-7B.



Thunderstorm damage to A-3 included loss of radome, airspeed and angle-of-attack systems.



Should you operate recip engines, from P-5 to C-45, you may become an unwilling player in a...

Guessing Game

A test hop to check a new carburetor on the port engine of an S-2E had been satisfactory and the pilot decided to give the copilot some landings from the left seat. Four touch-and-go-landings were completed but on the fifth approach, at the 90-degree position, both pilots noted strong fuel fumes in the cockpit. The pilot called for a full stop landing.

Just prior to touchdown power was reduced to idle on both engines. As the throttles hit the idle stop the copilot (in the left seat) noted a "flash and bang" from the port engine which he interpreted as an unusually large backfire. In the right seat, the pilot heard the bang and thought a tire had blown. Witnesses on the ground saw a flash around the port engine almost simultaneously with the wheels touching the deck, followed immediately by flames coming from the outboard side of the accessory section.

The true state of affairs was soon realized by the copilot who saw the port fire warning light illuminate. "Engine fire on deck" emergency procedures were used and the aircraft was braked to a stop. By this time there was more smoke than fire and the end result was incident damage.

The source of fuel fumes is sometimes hard to track down but in this case inspection of the port accessory section revealed that the B-nut on the main fuel inlet line on the carburetor elbow was found to be only "finger tight."

Judging from the fuel integrity tests performed after the carburetor change, investigating personnel concluded that the B-nut was tightened to slightly less than required torque and it backed off due to vibration during the one hour flight.

Whatever the cause of the fumes, the pilots were faced with the ultimate problem of what to do about them. A fuel leak is not always an immediate fire; airflow through the engine and accessory section may keep the fuel from contacting hot metal or exhaust

flames. The danger comes when power is reduced for landing or when the aircraft touches down. At this point the cooling and dispersing effects of the airflow decreases. If fuel contacts hot metal or mingles with exhaust flame—whoomp! You've got a fire.

In the incident previously discussed it was theorized that fuel was collecting in the bottom of the accessory section and could possibly have been running out of the lower cowling. In addition to entering the cockpit, fumes had filtered into the top of the wing aft of the accessory section and caused a minor explosion when ignition took place.

If fuel fumes were the only clue, it would be hard to figure out which engine had a leak. One instrument which *might* have given significant information was the fuel pressure gage, but apparently it was not checked as there is no mention of the pressure readings in the incident report.

What does the fuel pressure gage tell?

Some but not all of the publications for the reciprocators have a paragraph in the emergency procedures called, "Fuel pressure drop—engine operating normally." Two phases are covered; "during ground operation" and "during flight."

If you are cruising along at altitude with everything in the green and your attention is drawn to a slight loss of fuel pressure what would you prepare for? You might expect loss of power but if the engine kept operating as if nothing had happened you might decide that the gage itself was at fault.

However, if the gage is *not* at fault where is that three or four pounds of fuel pressure going? Well, probably it has found an unauthorized exit and is oozing around somewhere in your engine section. Under normal cruise condition the airflow is cooling the engine parts, blowing back or dispersing the fuel and things are continuing normally. But, as previously noted, any change in the airflow pattern may start a fire.

"It must be the objective of the crew," says one manual, "to eliminate the fuel before any change is made to the airflow or exhaust pattern.

"The most effective means of doing this," the manual continues, "is by moving the mixture control to idle cut-off prior to any throttle reduction, propeller feathering, or other engine shutdown procedure. An additional advantage of moving the mixture control is that it provides the most rapid means of eliminating exhaust flames and reducing exhaust heat."

It has been argued that securing with the mixture control considers only fuel leaks between the mixture control cut-off point in the carburetor and the engine. If the fuel leak were upstream of the mixture control shut-off point, the fuel will continue to leak. Therefore, the argument goes, the fuel tank selector valve should be turned OFF because it secures everything from the valve to the engine.

Turning off the tank to the engine is the same as running the tank dry. It would be all right if you can guarantee no surging or backfiring as the engine dies—people who have run the tank of a "Turkey" (that's a Grumman TBF, son) down to the last drop of petrol before switching know that backfiring is common in that situation.

So, as a general rule it appears preferable to shutdown with the mixture control, following with the remainder of the "Engine fire in flight" checklist. Part of that checklist concerns the fuel tank selector valve anyway.

Assuming you have more than one engine, but also assuming you need all of them to get to your destination, the flight manual method is to maintain the affected engine in operation at or above cruising speed, watching for fire. Before power reduction for entrance to the landing pattern, secure the affected engine and make a single-engine landing.

A fuel pressure drop on the ground should be handled as carefully as one in the air. In one case an S-2 was being given a high power turn up by the maintenance officer and a chief electrician. All engine checks and indications were normal except for 19 lbs of fuel pressure on the starboard engine vice the normal 21 lbs. After completion of several additional items of the check it was noted that the fuel pressure had dropped to 17 psi. When the throttle was retarded the pressure dropped further to 10 psi.

The maintenance officer sought to return the aircraft to its parking spot "before the engine quit." He taxied about 300 ft to the line. Upon arrival smoke was observed coming from the starboard cowling area and the engine was secured. The fire was extinguished by line CO_2 bottles. When things cooled down a bit it was found that the fuel pressure indicator line had a leak approximately 10 inches aft of the carburetor. This fuel leaked onto the oil vapor return line and down to the bottom of the nacelle.

When it comes to single-engine aircraft, there is not much guidance to be offered to the pilot with a fuel pressure drop or fuel fumes. Keep the engine running, watch for fire, and land at the first suitable field is probably the best advice that can be given. A good example of the hazard is furnished by a T-28 incident.

Shortly after takeoff the pilot smelled fuel fumes and he returned to home field and landed. He taxiied into the line area and completed normal scavenging

Fuel fumes during touch and go did not alert pilots to hazard of fire on landing rollout. No check on fuel pressure was made.

prior to securing the engine. Upon closing the throttle and placing the mixture in idle cut-off, a moderate explosion occurred followed immediately by fire from the accessory section. The cause: improper installation of the main fuel line to engine fuel pump. A twisted fuel line allowed the B-nut to back off enough to allow seepage of fuel from around the fitting.

An endorsement to the incident report provides some philosophy of operation for the future. "It seems prudent that pilots noting fuel fumes or becoming aware of an actual leak should land as soon as practicable. As soon as it is safe to do so, the fuel selector valve should be turned OFF, in order that fuel may be exhausted in the engine during rollout thus minimizing fire hazard."

If the records at the Naval Aviation Safety Center are any indication, few reciprocating pilots will ever have to play the "low fuel pressure" game. But considering that the subject is not covered in every Navy recip publication (eight out of 17 do not mention it) some pilots may not have been exposed to the rules. Incidentally, a check of flight manuals from seven airlines and civil operators show that only two make mention of low fuel pressure and even then it is a very brief mention. Some, but not all, of the Army recip aircraft manuals mention this subject. It appears that all of the USAF recip manuals do include a reference to low fuel pressure procedures.

Why all the fuss about incomplete coverage in the manuals? Knowing the answers could have prevented fire damage to a small civil multi-engine airplane when the problem was so obvious. Test your knowledge on the following example and imagine how you would handle it.

On a cross-country the occupants of the aircraft noticed what appeared to be a green liquid seeping from the seams of the right engine cowling. The engines were operating satisfactorily and all gages were indicating normal readings with the exception of the right engine fuel pressure, which registered 6.5 lbs in lieu of a normal 10 lb reading.

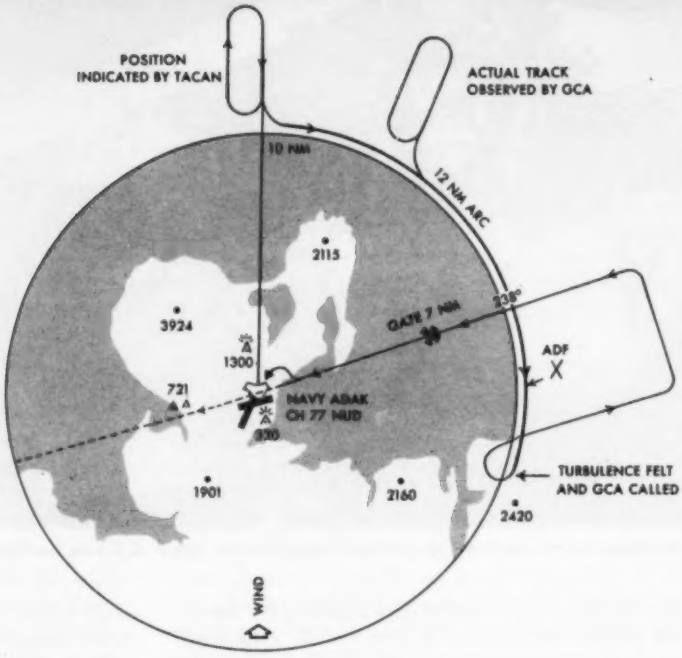
Sure, you can guess what was happening; and you can guess what happened at the destination. Fire, of course, broke out in the right engine nacelle during landing roll and it was necessary to abandon the aircraft on the runway (investigation revealed the main fuel line between the engine-driven fuel pump and the fuel injection unit was loose at the injector unit end. The fitting nut was about two turns loose).

Obviously you cannot cover the subject with only one rule. Before effective action can be taken (in the absence of fire indications), careful monitoring of all instruments connected with engine fuel system operation should be made in an attempt to determine whether the low pressure indication is caused by a fuel leak or a malfunction of some component of the fuel system. The behavior of the fuel flow indicators (when available), must be taken into consideration as well as the possibility of a partial line obstruction due to foreign matter or ice formation in the lines or components.

For this reason, a thorough knowledge of the fuel system components and their relationships to each other in the sequence of flow is necessary.

Anyone for ground school?

Lock-On Error



On return to Adak from a routine patrol the third-pilot/navigator of the P-3 was in the left seat. The weather was well above minimums, 1000 overcast, with 7 miles visibility, so I decided to pass up the usual GCA and let the third pilot shoot a Tacan approach.

After a few turns in the holding pattern at the initial approach fix we commenced approach, in the clouds with GCA monitoring us. Everything looked good on the 12-mile arc except that I didn't think the third pilot had pulled enough power off to make it down to 1500 ft at the seven-mile gate but I decided not to say anything and see how he would handle it.

After awhile I switched my Horizontal Situation Indicator (HSI) bearing indicator selector to ADF to cross-check our position; it showed us well past our inbound bearing but since our bird-dog had been unreliable the last few flights I figured that it was no good and switched back to Tacan.

We were just passing 3500 ft when we approached the inbound bearing (or what we thought was the proper one) and I remarked that we were going to be high at the seven-mile arc and suggested we take off some power to make 1500 ft at seven miles. About this time we got in some heavy turbulence which made me wonder about things (there was a strong south wind). As I was reaching to switch the bearing selector to ADF again, GCA called, saying that they had a faint target east of the field and requested our altitude.

A fast switch to GCA control, switch to ADF on the HSI, a level off, then we climbed to 3500 ft. Reevaluation of the situation revealed we were indeed east of the field flying in the clouds over 2400-ft peaks!

The flight was terminated with a normal GCA with a 40-degree error in the Tacan all the way into 3 miles. All I can say is thank goodness for GCA and 3Ps that are inadvertently high on Tacan approaches. If we had been at 1500 ft approaching what we thought was the seven-mile gate the flight surely would have been terminated by the mountains east of the field.

ANYMOUSE

The purpose of Anymouse (anonymous) Reports is to help prevent or overcome dangerous situations. They are submitted by Naval and Marine Corps aviation personnel who have had hazardous or unsafe aviation experiences. As the name indicates these reports need not be signed. Forms for writing Anymouse Reports and mailing envelopes are available in ready-rooms and line shacks. All reports are considered for appropriate action.

— REPORT AN INCIDENT, PREVENT AN ACCIDENT —

Lost Comm

We launched on an actual IFR training flight in the *Bugsmasher* with everything moving smoothly and according to plan. Destination weather was forecast to be 2200 broken and five miles at ETA.

After about one hour we were given a new frequency to work center radar. Unable to contact center we returned to the previously used frequency for further instructions. We were given two other frequencies to try, and if unable, contact enroute flight service stations. At this point the worm began to turn.

Transmissions on both of the assigned frequencies produced no acknowledgement although we could hear center talking with other aircraft. So then we called an FSS and were promptly answered. But now the worm hatched into the proverbial bundle of trouble.

Immediately after initial contact with FSS our UHF transmitter failed. Our airborne troubleshooting efforts were in vain. FSS attempted contact several times but never with any instructions. Eventually, however, another FSS directed us (on Guard receiver which was working 4.0) to contact center on frequency XXX.X. We listened on this one as center talked with everyone but us.

Departing the last enroute facility we shifted to destination primary approach control, hoping to hear a friendly voice. But there was still silence as far as we were concerned. Up to this point no one had attempted to determine whether or not we had the capability of receiving instructions—no identification turns requested and no transmissions over either Guard or VOR frequencies.

The last weather report we received had indicated conditions well above VOR minimums so we were going to try a VOR approach. It wouldn't be fun. This VOR was actually located at a jet field about 10 miles from our destination. The letdown procedure would involve mingling with jet traffic until well past low station on final approach to destination. I hoped ATC was preparing our way even if they were not talking to us.

While enroute to the VOR we heard approach control vectoring jets through various patterns around a tacan station which is close to the VOR. At this time we even attempted to contact destination Raspberry. There was no response although we heard a station 500 miles away with ease.

Arriving over the VOR at ETA, still in actual IFR conditions, we commenced an approach. During the letdown prior to turning inbound, we heard one of the jet aircraft notify approach control that a *Beechcraft* was over the jet field in what appeared to be an approach pattern (that was us). We felt that this was probably the first time approach control was aware that we were in the area. However, APC still made no attempt to identify us or issue instructions.

Believing the weather to be still above minimums, we proceeded inbound from low station and started our letdown to minimums.

At ceiling minimum and 3 miles (minimums being 600 and 2 due to the distance from facility to field) we were still solid instruments. Then finally GCA was heard from (on Guard and barely audible). We were given instructions for a no-gyro approach and upon landing found that actual weather was 300 feet and ½ mile in fog and drizzle.

Upon checking in with the operations duty officer, we learned that the only word they had about us was that center had passed our position about 30 minutes out, but they had not passed the fact that we had no transmitter. At this time the transmitter had been out for over an hour. APC's first knowledge of our position and situation was when the jet briefly saw us over the jet field and relayed our position.

Ground factors were:

- Center neglected to determine our receiver capability when they still had us in radar contact.
- Flight service, we believe, failed to notify center that radio contact had been lost.
- Center neglected to notify APC that we were inbound with radio failure.
- Destination Raspberry circuit was not monitored thereby rendering our only means of communication useless.
- APC failed to attempt contact or identification when notified that an aircraft was on approach.

Aircraft factors were:

- I could have turned up the VOR receiver volume and monitored the weather situation on the 15 and 45 broadcasts. But then when it deteriorated below my VOR minimums I would have had to make a decision to go to my alternate and the way things were handled, that could really have been hairy.

Reader Questions Headmouse Answers

"No, No, No, its ODD plus 500 up to 179 degrees!"

Have you a question? Send it to Headmouse, U. S. Naval Aviation Safety Center, Norfolk, Virginia 23511. He'll do his best to get you and other readers the answer.

Leg Garters

Dear Headmouse:

After donning my brand new Mk-5 anti-exposure suit with gloves in the lower left pocket and inflatable head piece in the lower right leg pocket, it soon became apparent that the Martin-Baker type leg restrainers were barely long enough to fit around my left leg and about 2 inches too short to fit around my right leg. Solution: Put head piece in left upper leg pocket. Unfortunately, a large bulge in this area is awkward and uncomfortable. Recommend increase length of leg restrainers.

J. R. CRAFFMAN, LT
170 LB PHANTOM PHERRET

▶ If you mean leg garters instead of leg restrainers (and we think you do) your parachute rigger can make them larger for you. Incidentally, before pocketing your inflatable head piece for your Mk-5 anti-exposure suit, make sure it is completely deflated.

Very resp'y,

Headmouse

Safetying Electronic Equipage

Dear Headmouse:

The Quality Control Division has done extensive research in the field of lockwiring electrical and electronic equipment. We have endeavored to substantiate rumors that, in essence, state . . . "Equipment readily accessible in flight and not subjected to high vibration, need not be secured with lockwire."

The latest publication available to the squadron and to the O&R at North Island is the *1954* revision to the Mil-I-8700(ASG). We have reason to believe that the information therein concerning the securing of electronic and electrical equipment is not current, and, if so, it necessitates a revision or consideration for the exemption of multiengine aircraft from the Military Specification for safety reasons.

Although lockwire is extremely advantageous for most military aircraft; those subjected to sudden starts, stops and similar stressing conditions, we feel that it is derogatory in our most common emergency—the Single-Engine. In order to maintain a safe flight altitude in a single-engine situation it is often necessary to lighten ship by jettisoning some of the electronic equipment. We have found our jettisoning operation jeopardized when it was necessary to procure a lockwire cutting tool and cut the lockwire on all the equipment as additional steps prior to preparing to lighten ship. Time is our most important consideration in this case and we feel that we are sacrificing too much.

The equipment in our specific aircraft —the SP-5B—is subjected to very little vibration in areas other than the engine nacelles, wings, and the tail section. We feel that it is an unnecessary safety feature to lockwire the equipment in other areas of the aircraft.

Any information that you can supply us with will be deeply appreciated.

JAMES E. O'DONNELL, VP-50

▶ Research here, and discussion of this subject with BuWeps, cannot substantiate the rumor you mention. On the contrary, Specification Mil-I-8700 (ASG) 27 Aug 1954, "Installation and Test of Electronic Equipment in Aircraft" is still current and binding with the exception that MS 33540, "General Practices for Safety Wiring" is being revised to specify the uses of lock wire, seal wire and shear wire. The changes were published in the April 1966 issue of APPROACH, page 22.

According to Mil-I-8700 (ASG) paragraph 3.8, Safety Wiring: "Equipment snap-slide fasteners and *other fastening devices that provide for means of safetying shall be safety wired to prevent vibration from loosing equipment during flight* (italics ours). When the component is equipped with four snap-slide fasteners, it will be satisfactory to safety wire only two diagonally opposite fasters. Safety wiring shall be in *accordance* with Standard MS 33540. Tape of any kind shall not be used for safetying components." BuWeps ltr RAAE-333/205 GDN of 15 March 1965 to Commander, NASC states: "Shear Wire, as an antivibrational device, is acceptable for securing wing nuts, etc., to mount electronic equipage.

The subject of jettisoning procedures was discussed in the Dec

1964 issue of APPROACH, pages 22 and 23. In summary, the answer to your query is:

1. Safetying of electronic equipage is required where fastening devices are provided.

2. Shear wire shall be used in such applications.

Very resp'y,

Headmouse

Bolt Installation Practices

Dear Headmouse:

Not until this year have I found so many squadrons not observing standard maintenance practices of installing bolts with heads to top, aft or inboard.

I have noticed this practice in my job as a Quality Control Inspector and General Aircraft Inspector and recently was asked to prove my point concerning bolt installation. I have requested assistance from tech reps and even they had no luck finding anything in writing.

I respectfully request your comments on this subject.

W. E. PARKS, ADJ1
NAS, MIRAMAR

▶ You're right, Inspector Parks. The information you seek is in writing and can be found in Aeronautical Technical Inspection Manual, NavAer 00-15-500, Volume 8, Aircraft Components, Page 10, Section I, Paragraph 4, sub paragraph (f) Installation of Bolts and Nuts, item 5, which states: "Wherever possible, see that bolts are placed with head on top or in the forward direction. This positioning will prevent a bolt from slipping out if the nut is accidentally lost."

Concerning bellcranks, levers, and quadrants: Page 80, Para. 4, subparagraph (e) item 6. *Position of bolts*: "When possible, all bolts must be installed with head uppermost or facing forward. In spanwise installation, the accepted practice is to install the bolt with nut on the inboard end."

Although this manual was issued 9/1/46 it is still valid. Please refer to NavSandA Publication 2002, Navy Stock List of Publications, Section VIII, Part C, Page 8C-1 for a listing of 00-15 series of Inspection Manuals. Every quality control unit should have ready access to these manuals which have a wealth of information on good workmanship practices.

Very resp'y,

Headmouse

Corrosive Agents

Dear Headmouse:

When a fire developed in a T-29's port engine accessory section it was put out with eight 30-lb PKP extinguishers. Powder removal was complicated in some areas by oil and fluids from fire-damaged lines, but the residue was immediately removed by using compressed air and wiped clean with rags and solvent.

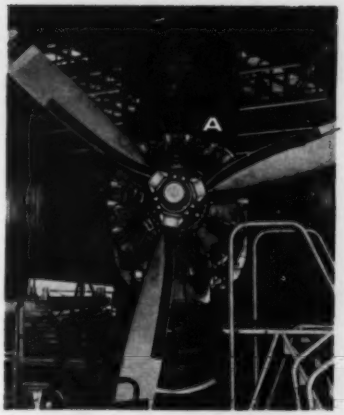
After fire damage repairs, the aircraft was returned to service. During a major inspection 50 flight hours later, extensive corrosion was found in all areas which had been exposed to PKP. Corrosion damage/repair required 1000 man-hours. (See photos at right)

Information is requested concerning the practice of using dry chemicals on engine fires and any history of corrosion problems associated with the use of dry chemicals.

VT-29

▶ Although NavWeps 00-80-R-14, Aircraft Firefighting and Rescue Manual, paragraph 3-41 states, "Corrosion will be minimized if the area is properly cleaned up after the application of dry chemical, which may be accomplished by the simple act of using an air hose to blow out any powder residue", this cleaning method is ineffective in congested areas and complete disassembly and overhaul may be necessary.

BuWeps ltr SFM-3/451:REF of 27 April 1965 and BuWeps Inst 11320.2A set forth the policy in



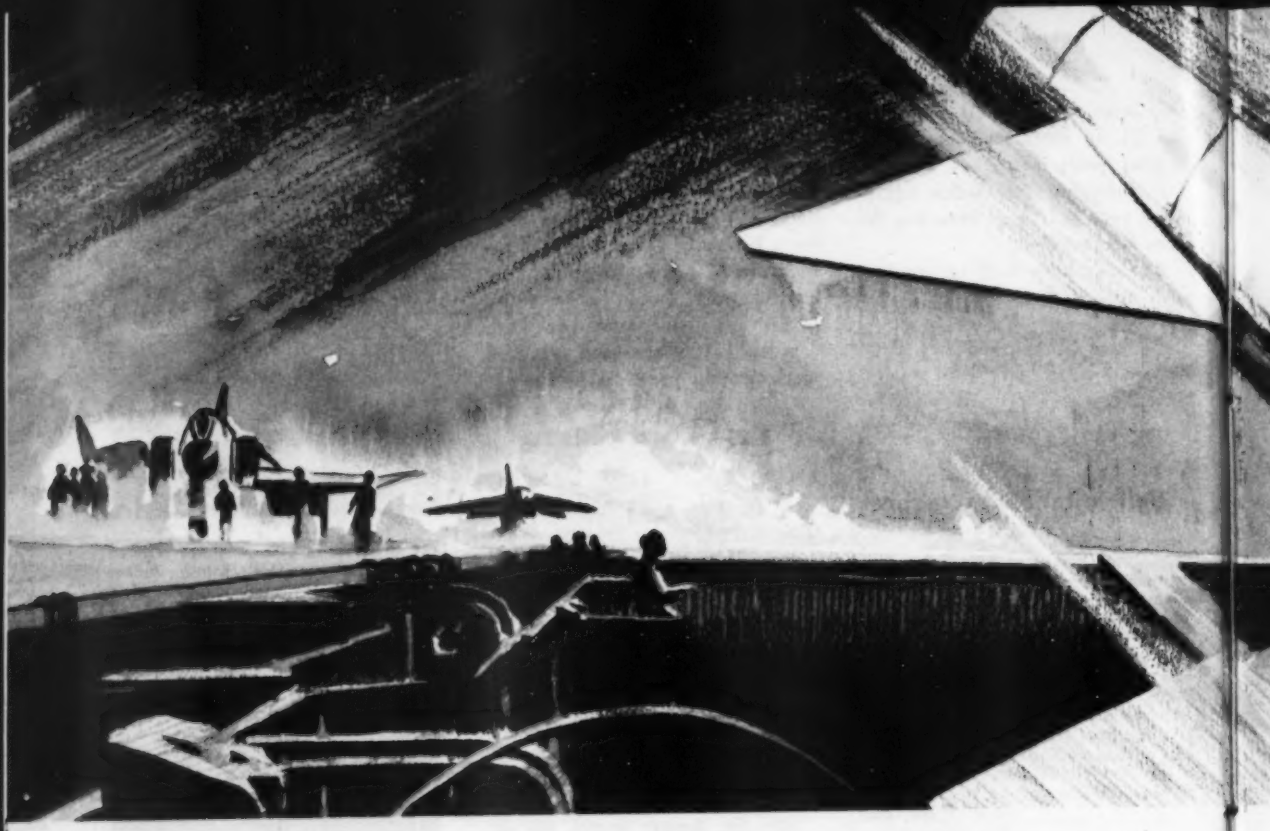
PKP directed to area A above resulted in extensive corrosion. Below: Arrows point to rivet heads corroded off.

regard to the use of dry chemical. In general, carbon dioxide extinguishers should be the predominant extinguisher on the flight line and used first. Dry chemicals should be used as a back-up when the fire cannot be contained by other extinguishing agents.

Since publishing of BuWeps Inst 11320.2A there have been no other reports indicating a corrosion problem from the use of dry chemical fire extinguishing agents.

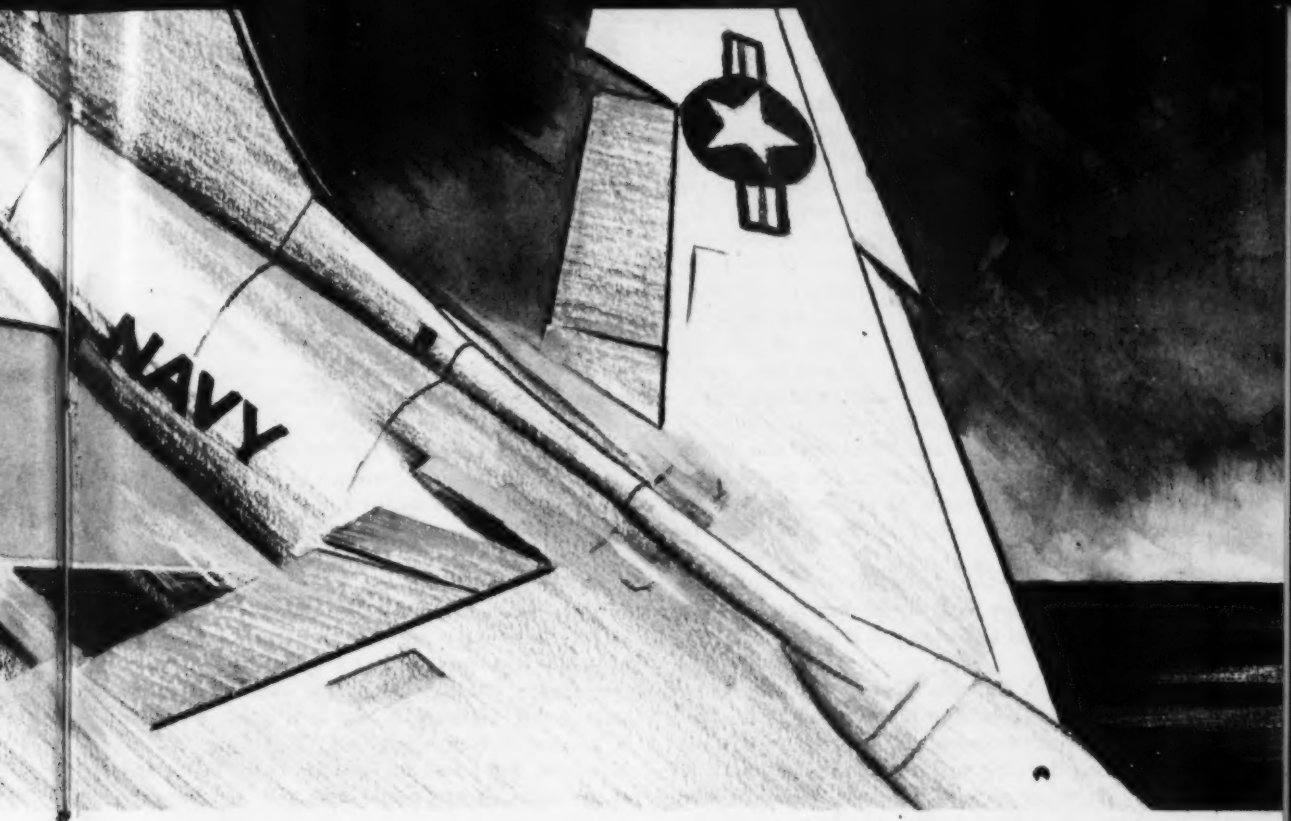
Very resp'y,

Headmouse



Underwater Ejection

a four-minute drama



Returning from the Mediterranean after a seven-month deployment, the carrier's Air Wing was scheduled to fly off some 300 miles northeast of Jacksonville. All aircraft were in up status and the entire Air Wing was to launch commencing about 1300. It was a beautiful day, 32 kts of wind across deck with a very slight pitch and 12 kts of natural wind.

For the first part of the fly-off, the starboard and port catapults both had been used to launch A-1 *Skyraiders*. The deck was then stopped and the *Crusaders*, the next group to go were spotted on both catapults. The squadron CO, whose story this is, was to be launched from the port catapult.

"The catapult officer then turned to me," our pilot begins. "He gave me a turn-up signal, checked the tension on the catapult, and gave me the burner ignition signal. I ignited the burner and checked my instruments—all were normal. He then pointed forward and touched the deck and the catapult crew punched the button.

Cold Cat Shot

"Instantly, within a second, I realized that I did not get a full catapult shot. I felt the holdback fitting break but I did not accelerate. I knew I was getting a cold shot. I came out of burner, pulled the throttle to idle, and then shut the engine off. By this time I had rolled about 22 ft up the track. I applied both brakes with no noticeable deceleration. I then tried to slow my airplane with nose gear steering to pull the nose toward the center of the deck in the hope that I could skid the airplane sideways and stop it before going off the bow. This did not work either, because, though I didn't know it at the time, the shuttle was still attached to the catapult mechanism. My aircraft was being pulled down the deck under steam pressure." (*The catapult bridle remained in place. Apparently, the catapult launch valve failed to open properly allowing only a small amount of steam to the catapult.—Ed.*)

". . . As I continued down the catapult track, I thought, 'I am not going to stop. I will eject before I leave the flight deck,' and I reached up and grabbed the face curtain. But then it had also occurred to me that I would not have enough airspeed and certainly not enough altitude to guarantee a successful ejection in the Mk-5A seat. I instantly changed my mind and decided to ride my airplane into the water because I was of the opinion after some study of the *Crusader* and other jet aircraft, that your chance of successfully ditching the aircraft with the engine shut down is quite good. With the engine running it is very, very poor—less than a 2 percent chance of preventing an explosion. But I had shut the engine down. I checked the tachometer and observed that my RPMs were going through 30 percent, descending, decreasing. For this reason, I decided to ride the airplane in.

"I reached up before the plane ever left the carrier bow and put my hand on the emergency canopy jettison handle, but I did not pull it as I should have done."

Board's Views

The Aircraft Accident Investigation Board considered the pilot's actions in securing the engine, commencing braking and attempting to steer the aircraft inboard correct. "That he discarded the possibility of ejection is also considered correct because of the low airspeed. The time consumed by his consideration of ejection necessarily reduced the time available for him to properly jettison the cockpit canopy. Thus he entered the water with his canopy in place. . . . The pilot should have jettisoned the cockpit canopy prior to water entry," the Board stated. "This is a NATOPS requirement. Had he done this, he would not have been forced to eject from the aircraft."

"Why I did not jettison the canopy, I don't know," the pilot continues. "Perhaps it was fear—wanting to have the capsule closed when I hit the water. I have known no fear in thinking about this subject before. I actually believed that my chances of jettisoning the canopy were as good when I hit the water as they would be in the air. And I wanted to know in what attitude I hit the water; I felt that with the canopy off, perhaps I would not know this.

Over the Bow

"I knew I was moving slowly. It was estimated I was going 27 kts as I left the ship. That certainly is not enough to fly. I had no response from my control system at all. The aircraft continued over the bow at a slow speed and dropped nose first but very gently. In my own impression, it was very gentle —easing down into the water. The jolt on hitting the water was not significant at all, not as much as a carrier arrestment. (*It was estimated the aircraft struck the water in a 45-degree nose-down attitude. —Ed.*)

"Water immediately splashed over the top of my canopy and I pulled the emergency canopy jettison handle with no success. The canopy opened slowly —the very front end—and raised up and dropped back down again solidly under water pressure. It began to get dark and water began to come up in the cockpit, covering my legs and starting up my torso and up the seat. I then pulled hard on the canopy jettison handle again and realized that I had already fired the cartridge and it was not going to come off. I put my hands on the canopy and pushed as hard as I could without success. I could not even budge it.

Weighs Alternatives

"It became evident to me that I was going to have to either equalize the pressure inside the cockpit and out, by letting the airplane sink and opening my cockpit vent to let it fill, or I would have to knock that canopy off in order to get out. While I was making this summary in my own mind, I noticed it became lighter above me. This gave me an indication that I was not very far below the surface of the water. It had gotten dark and then began to get light again."

"I then made a decision to try to eject to clear myself from an airplane that was sinking rapidly. I didn't know whether there was fire on the surface —whether fuel had ignited, or how much my airplane had broken up. The impact shock had not been so great—I assumed that my cockpit was intact and that my seat would still function. With water to my chin, I reached over my head (without using the canopy interrupter which would have been a proper maneuver to fire myself through the canopy) and pulled the face curtain. Apparently when the canopy had partially jumped off the first time, it had armed the ejection seat because it did fire and pushed the canopy clear. Without my ever knowing about the canopy's existence, I popped up out of the water. I felt myself leaving the water. I felt pressure on my legs while in the water and none when I left the water.

Tumbles, Re-enters Water

"I tumbled forward an estimated two and a half turns and popped some 20 ft above the water's surface. I rolled forward, hit back into the water face to, head first—still in the seat. The seat had not separated. Almost immediately on contact with the water, I felt a little charge go off as the seat separated.

"I went under water a considerable distance and

Ejection force carried me 20 ft above the surface—only four minutes elapsed between the cold cat shot and helicopter rescue.

the jolt coming back into the water from the ejection was considerable. It knocked all the breath out of me. But as I struggled for breath again, I noticed that I was breathing very comfortably under water on my bailout oxygen supply with no problem whatsoever. Although I did not have my helmet visor down as I probably should have, the water in my face was no problem. But when I hit the water coming back, the curtain still up there on my face, it was one hell of a jolt and it did knock the breath out of me and caused some soreness later on. I breathed comfortably; this reduced panic considerably. I felt no worries at all of any magnitude after I was in the water again. I realized I could move freely and breathe freely under water.

Pops to Surface

"I inflated my Mk-3C life preserver and it immediately popped me to the surface. When I came to the surface, I was abeam the port quarter of the carrier and it was moving sideways away from me. The captain had put the rudder hard over the starboard first, and then hard port. This made the bow miss my airplane and then made the stern and screws turn away from me. I watched the ship with the hull being some 12 to 14 ft away from me, moving sideways from me. It was a wonderful feeling because I could hear the screws—the motion of the screws—and the cavitation in the water and it was becoming dimmer. I knew I was going to clear the screws. I felt fine!

"I had no sensation of hurting at all and decided I had best get out of the parachute, because I could feel a tug on it. By the time I could put my hands on my shoulder rocket jet fittings to release the parachute, it was already pulling me under the water. The eddies of the ship's screws were causing a whirlpool action and the chute tangling in the action was pulling me down. Because of the tension on the rocket jet fittings, I could not release either of them. I could not reach the left fitting comfortably; I could reach the right one but I could not release it. I then doubled up and ducked under water, taking pressure off the shoulder straps and the rocket jet fittings. The starboard fitting came undone rapidly with no problem at all and then the pressure came off and, still breathing comfortably, I popped back up to the surface. With the seat pack attached, the parachute gone and downstream, and myself back on the surface all within perhaps a minute and a half, I realized that the devil was not ready to be relieved and that I was in fact in good shape and was going to be rescued.

Helicopter Approaches

"I saw the ship then some 80 to 100 yards away from me and slowing down. The fly off launch had been stopped, of course, and as I turned around to survey my position in the water relative to the wake, I saw the helicopter approaching from the stern and dumping fuel. This is a jet *Seasprite*, our standard rescue helicopter on the ship. As the helo approached, the three-bladed spade seat was being lowered.

"The water whipped up drastically. Because I did not have my helmet visor down, little pellets of water were pounding my face and eyes enough to make me turn away from the approaching helo. The rescue crew and the helicopter pilots put the spade seat down within four feet of me, off to my left. Having undone the left retaining strap, I held on to my seat pack with my right arm until I was sure I was going to be able to get the seat. I wanted to hold on to the raft in case I had to use it. As soon as the seat was there and within my reach, I released the starboard fitting on my seat pack and the pack disappeared. I made two strokes, got hold of the spade seat, straddled it, crossing my legs, hugged it tightly and was lifted into the helicopter. I was back aboard ship in less than four minutes from the time the catapult was fired.

Lands Aboard Ship

"With my Mk-3C emergency flotation equipment still inflated, I climbed out of the helicopter. I was offered a ride by the corpsmen in their litter but decided I didn't need that at all. I walked back down the flight deck, still dripping slightly but feeling grand and waving to the other pilots in my squadron. . .

"There is much to be learned from this ejection, I think. . . My own feeling is that the M-B ejection seat is an effective escape mechanism . . . and it will, in fact, work under water because I was covered up to my chin when I pulled the curtain. We have known for some time that there is a possibility of a seal in the bottom of the gun permitting water to come around the cartridge, thus preventing a proper firing of the cartridge which is the initial cartridge in the ejection. This obviously did not occur in my case because the system worked perfectly. *(Incorporation of ACSEB 34-61 (Seal MBEU 18605) insures watertight integrity. Old seal (MBEU 15868) was found to be unsatisfactory when gun was tested at underwater depths of 150 ft.—Ed.)*

Opinion on Ejection

"I believe ejection is an effective way to get out of an airplane that is ditched. I don't recommend ditching any jet airplane if it can be helped. I would use the ejection seat myself in the air if at all possible. But should you dribble off the bow like I did and go into the water, I would recommend ejection without any qualms. The jolt is not hard on your body. You can take it, certainly, and I think your chances of escape in this manner are very good.

"As to my thoughts about ejecting when the water was coming up to my chin, the fact that the water was becoming lighter above me told me, subconsciously, I think, that I was close enough to the surface. Quite frankly, I would still have ejected had it been dark and had I known I was below a depth of 10 ft. I have not computed the forces of water pressure on the human body but I think, rather than let the airplane crush around me, I would make an effort to get out before I got too deep. Had I stayed with the airplane, perhaps the pressure inside would have equalized permitting me to remove my canopy, pull the ditching handle and climb out of the seat. Even if the water had not turned light again, I still think I probably would have ejected. I might not have come out as well as I did and I'm grateful for the luck, but I believe, in my own opinion, that this seat will function lower than 10 ft. I shall be very interested in any records on this subject in the future."

(For further material on ditching, ejecting and underwater escape, see the article "Ditch or Eject" by CDR Fred Pester, APPROACH, *July, 1964, and the new movie, "Escape from Ditched Jets," MN-9856, Unclassified.—Ed.)*

Survival Field Test

An SH-34J on a daylight cross-country flight experienced a loss of power while flying above a mountain ridge line at 9200 ft. Aboard were two passengers in addition to the pilot and a crewman flying in the observer-copilot position.

Attempts to recover power were unsuccessful. The aircraft cleared some tall trees and rocks then, rapidly descending, impacted the six-foot crusted snow pack, wheels level, nose first. Rebounding backwards 12 ft, the helo rotated 150 degrees. The tail pylon separated and the main rotor blade sheared off the tail section aft of the cabin.

At first impact, the two passengers in the crew compartment were thrown forward, heads between their knees (their shoulder harnesses were not fastened). Survival gear, radio equipment and debris aft of the seats came flying over their heads, then reversed direction and again passed overhead when the tail section struck the ground on rebound. No one was injured. The time was about 1100.

The four men left the aircraft. Until they were sure there was no possibility of fire, they stayed at a safe distance. Then they returned to the aircraft to salvage the survival equipment, warm clothing and whatever they thought they might need.

Some 100 yards down the slope, where there were trees for protection from the weather, they established a camp. After setting up a parachute for a windbreak, they built a fire and gathered enough wood to keep it going continuously. They inflated the Mk-4 life raft and insulated the bottom with seat cushions to sleep on. A second parachute became a cover.

All the food the survivors had was four bouillon cubes and three chocolate bars in the crewman's PSK-2 survival kit. None of the other men was carrying a PSK-2. All four men had on thermal underwear under their summer flight suits but only one man had a jacket.

During the afternoon, they saturated rags with oil and gas to burn as an emergency signal and readied a pyrotechnic kit and a PRC-17 radio. Attempts to attract the attention of a high flying commercial aircraft with a signal mirror were unsuccessful.

Supper that evening was one candy bar divided, chased by bouillon prepared with one cube and melted snow heated in the metal case of the PRC-17.

During the night the temperature fell to 14°. Two-hour fire watches were maintained. Earlier, a wolf had been sighted near the camp but had been frightened away.

At daybreak, the crewman spotted a P-2 and woke everybody up. The men fired several flares but attracted no attention. Shortly afterwards the survivors saw an S-2 and fired a volley of star shells and smoke flares, ignited the oily rags and fired a second volley of flares.

At this point they decided the downed helicopter had to be burned to attract attention. The aircraft was on an incline of 30 degrees. The copilot let some fuel out of the tank and ignited it with a flare.

At 0630, a search helicopter sighted the black smoke and established visual and radio contact with the survivors.

The SAR pilot directed fixed-wing aircraft to the site, dropped blankets to the survivors and departed. The helo's fuel state and the small hover/landing area available at the clearing prevented pick-up by this helicopter. The S-2 and P-2 continued to orbit the site until two Air Force helicopters arrived and landed at 1000. Each picked up two survivors.

Ironically, the mission of the SH-34J had been to drop the passengers off at a training school. One was to have delivered a survival lecture and the other was to have observed the training program.

So Who You Kidding, Tiger?

LT R. E. Atkins, MC

One dark evening, during the early months of a past Med cruise, a thoroughly shaken young naval aviator burst into the flight surgeon's office in full gear and sounding an eloquent plea. Verbiage aside, it amounted to "Never again!"

It seems that prior to the cruise, this tiger had been found to have defective vision. His eyes were still better than many but fell outside the stipulated 20/30 of naval Class I. So highly motivated was this young man and so convincing his argument that the flight surgeons, having heatedly debated the point amongst themselves, used their own eloquence to achieve a waiver and to salvage for the wing an outstanding 'Gator pilot.' The matter thus settled, no more was heard until the dark night in the Med.

While manning his aircraft, our tiger was horrified to find that his glasses, judiciously purchased from a civilian optometrist and never mentioned in squadron territory, had dropped out of his flight suit and gone to the deep. A contrived down at this time would threaten to bring up embarrassing questions so he was catted into the soup and left to his own devices. The hop went pretty much as planned but the story of that recovery—eloquent? It was positively histrionic and the LSO had some rather clever remarks to add upon coming directly from net to readyroom.

The upshot, of course, was that a lesson was learned by all, said tiger going on to do very well in Class II flying and said flight surgeons left to dwell upon the error they had made. No one was hurt; it doesn't always work that way.

Why is it that a special board of flight surgeons, which will debate long and hard and eventually even permit a man with artificial limbs to fly, will debate not at all and invariably change the status of a man who comes up with inadequate vision? The answer is no secret; it has to do with good old Roger Ball.

Many things in life depend upon the accuracy of man's vision. Most of them can be checked by other men, discussed and decided "en committee." Bringing a multimillion-dollar aircraft aboard a carrier, however, depends upon one pair of eyes alone. It's somewhat analogous to the tree falling in the deserted forest where no sound exists if there is no ear to hear it. That ball may wink enticingly but if you can't see it, Buddy, it isn't there.

The refractive error of Tiger No. 1 (above) and of Tiger No. 2 (whom we'll get to momentarily) is called astigmatism. That crystal clear dome covering the iris which glares at you in the morning mirror is called the cornea. Its curvature is largely responsible for your eye's focus. Under ideal conditions, it can be likened to half a basketball, perfectly round and able to bring all the light rays passing through it to a point focus. The astigmatic cornea is more like half a football. Here the curvature is an elliptical dome and light rays passing through are usually brought to focus in two lines, 90 degrees from each other. Unfortunately, the lines are not superimposed. One lies ahead of the other. This tends to confuse one's all-important brain by passing on a distorted image. It's not what you see that counts, it's how you see it. You may, with astigmatism, be able to discern an object such as the ball but your ability to establish its spatial relationship is sadly impaired. Approaching the ball rapidly on glide path just complicates the optics involved.

As air groups will, we're warming up for another long boat ride. Carquals have turned up another interesting case: Tiger No. 2. The squadron LSO, having perhaps learned his lesson along with the rest of us, turned to the flight surgeon on the platform one night and said, "Doc, are you sure this guy's eyes are ok? I don't think he can see the —(colorful)—ball." The flight surgeon hustled off to do an examination and sure enough—an astigmatic problem, which had been waived in preflight, had increased and had been complicated by myopia (near-sightedness). The point is that Tiger No. 2 knew it and had been protecting his bad eye by raising the shield to read with the other eye during annual exams. The squadron skipper did a bit of testing on his own and found that the pilot in question more than halved his lateral distance before the two of them read a hangar sign with equal accuracy.

Visual acuity defects are rarely caused by neglect or misbehavior, they just grow that way. Sometimes the human head, in reaching full maturity, incorporates changes in the shape of an eyeball which distort the cornea (astigmatism) or pull the retina back away from the point focus of the eye's optical system (myopia). No stigma may be attached to such natural occurrence but plenty may hinge on the outcome.

First of all, there are a lot of us down here on the deck who would rather no one blunder down and flyswat us with a flying furnace, extra pay advantages or no. Secondly, there are a lot of two-man aircraft around now and if that crewman isn't in command because he can't see well enough, he certainly isn't going to thank you for taking chances he can't and wouldn't take himself. Thirdly, ignoring the obvious financial responsibility, the thinking man's aviator is far too fond of his skin to chance it becoming a ramp wrapper unnecessarily. So who do you think you're kidding, tiger?

SEA SURVIVAL

THE sea is so immense and uncontrollable that from time immemorial man has regarded it with awe and frequently fear. Even though we have in a sense tamed the oceans of the world by learning to cross them in ships and in aircraft, still many men recoil from the idea of challenging a great body of water in an open boat. It is, of course, reasonable to maintain a healthy respect for the sea as you may encounter it in a life-raft, for if you are to survive you must be prepared in many ways to combat a merciless adversary.

As the sea inspires unreasoning fear in some men, however, it only challenges others, who have determined to face the sea and defeat it. These are the men who, shot down or torpedoed in World War II, refused to give in to fear and survived for months in crude rafts. These are the men who, for the sheer love of adventure, have crossed whole oceans in open boats and rafts, following currents, navigating by stars, and sailing. These are the scientists who have sailed frail craft into the sea to gather data and record what men must do to survive under minimum conditions of water, food and shelter.

As a result of the experiences of these men, we now know that sea survivors stand a good chance of coming home again. Equipment, of course, is important and the equipment you will take with you is the finest in the world, continually tested and improved so that the Navy's own will lack nothing they could reasonably expect to have if they hit the drink.

When a native of a Micronesian atoll sets sail across miles of ocean, however, he takes with him something which you yourself must develop. This quality—which enables island people to cross as many as 500 to 600 miles of open sea in a frail outrigger as a routine operation—is *self-confidence*. The native knows what he has to fear and watches out for it. He uses his head.

This is an important quality. It crops up time and again in reports written by men who have survived the sea. You can see it in such recurrent phrases as "I reasoned. . . ." "We figured. . . ." "The PPC took charge. . . ." "Getting into the raft was orderly. . . ." These are the words of men who knew what they were doing. These are the words of *survivors*, the ones who succeeded. Now is the time to learn what you must know to combat the open sea.

—NavWeps 00-80T-56
(Revised 1961)

NOTES

from your Flight Surgeon

Cigarettes and CO

Do you think hypoxia isn't a problem for patrol and ASW crews? Don't fool yourself! On prolonged flights many of us experience symptoms of hypoxia as low as 7500 ft.

You don't fly that high?! Wrong again! Cigarette smokers maintain a blood level of carbon monoxide of between 5 to 10% saturation, simulating a *physiological altitude* of between 7,500 and 10,000 ft at takeoff. Just add this to your true altitude on your next flight and think again before you light up the next one. (And remember, it takes 20 minutes of 100% oxygen to wash the body clear of the carbon monoxide of one cigarette.)

Now about those early symptoms of hypoxia. These are insidious in onset, beginning between 7,500 and 10,000 ft, the earliest being a reduction in night vision, impaired judgment, early fatigue and irritability. From 10,000 to 15,000 ft (physiological altitude) visual changes are more prominent with headache, poor discrimination and a slowing of reaction time. Again these symptoms are insidious and one must be constantly alert to their presence. And remember, any increase in activity tends to accelerate symptoms of hypoxia.—*Flight Surgeon, NARTU, NAF Andrews*

One-Time Issue

A carrier's monthly flight deck injury tabulation included a number of items: "JP-5 in the eyes" and "foreign object in eyes." Fortunately none of these eye injuries caused permanent damage.

"Some people keep goggles up even when we're conducting flight ops," the carrier's Safety Council states. "Between recoveries 'goggles up' is universal."

Don't risk your eyesight. Wear your goggles down during flight ops and when pumping JP-5. Eyes are issued one pair per lifetime!

Survival Training

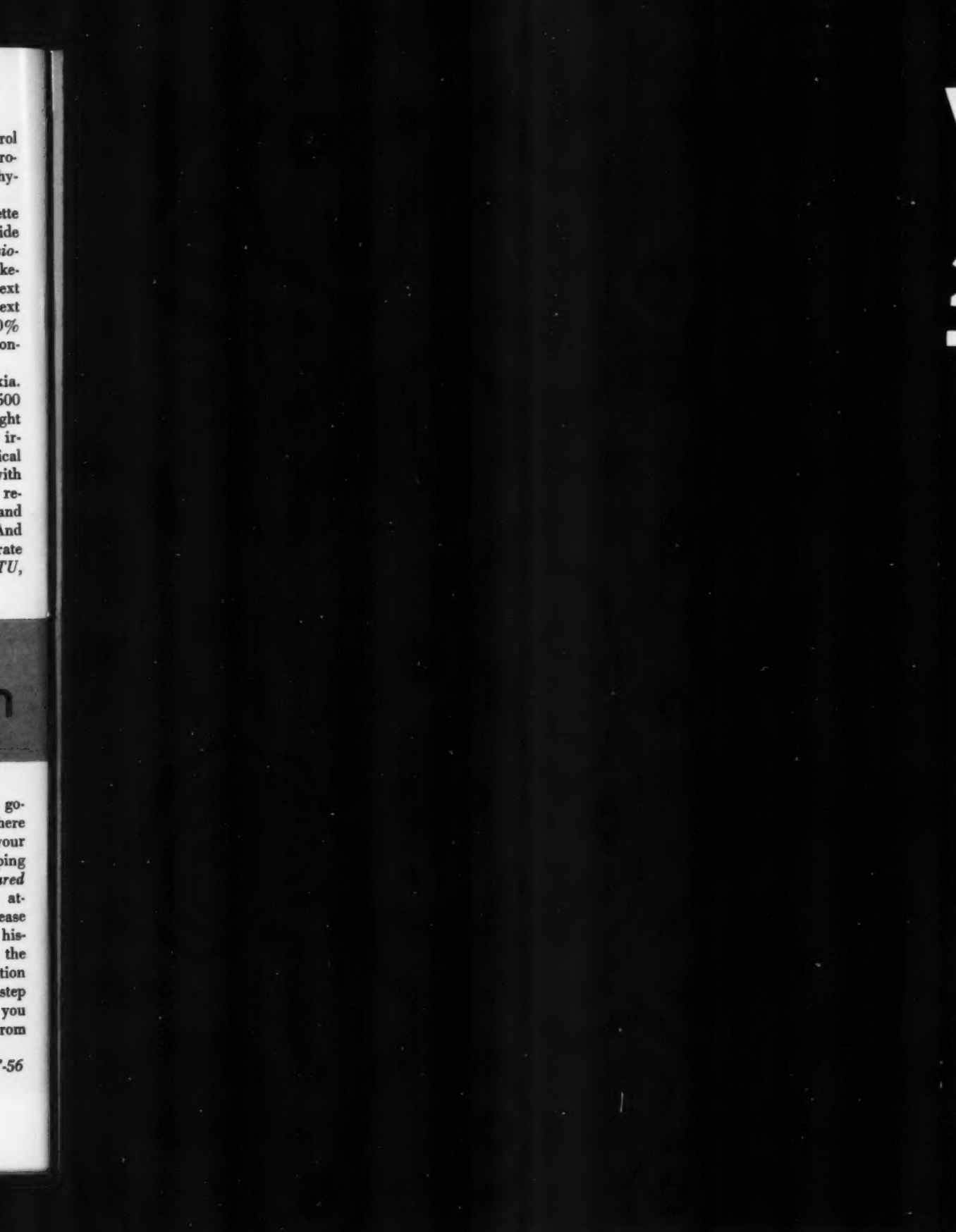
THE VERY best kind of survival training is the kind that is practiced and mentally stored away to the point where you don't even have to *think* about reorganizing yourself in the moment of crisis.

—*NavWeps 00-30T-56 (Rev. 1961)*

Face Up To It

NO MATTER what the physical conditions are, the most dangerous kind of survival situation mentally is the one that comes as a big surprise. Wherever you're going, whatever you're doing, there should be no such thing in your mind as "the unexpected." Hoping for the best but *being prepared for the worst* is the everyday attitude that will definitely increase your survival chances. Case histories prove it. . . . Facing the possibility of a survival situation every day puts you one big step ahead when the crisis *forces* you to reorganize your thinking from routine to emergency.

—*NavWeps 00-50T-56 (Rev. 1961)*



The Man-Machine Complex

By Charles I. Barron, M.D.
Medical Director, Lockheed-California Co.

A study of a pilot's reaction to environment stimuli is incomplete unless considered in the proper perspective of man in a man/machine environment. Man and his machine must be considered as a single functioning unit. For example, the basic stimulation received by man is derived from the various displays within the cockpit of his aircraft. Having received this information, he may make a decision which results in a muscle response initiating changes in the attitude, speed, altitude, or power setting of the machine. This, in turn, is translated into a feedback of new information to the man which either may satisfy his desires or result in further commands and actions being relayed to the machine. Since both man and machine are responsive to stimulation within the ambient environment, we can neither logically delete the machine nor the total environment from a study of pilot behavior.

It has been stated that the two commonest causes of human factors accidents are the overloading of man's sensory channels and the simple "goof" caused by carelessness or inattention. Obviously, no pilot in his right mind will deliberately make a mistake which could result in his injury or death; consequently, it must be assumed that the majority of accidents are caused by the aforementioned factor. It becomes increasingly important for all people concerned with aviation—designers, operations and supervisory personnel—to better understand man's frailties and limitations to avoid exceeding his capacity to sense, integrate, make decisions, and act. Even the most capable pilots may be guilty of so-called pilot error, but it must be remembered that we frequently assign the most difficult and exacting tasks to them—in short, the toughest jobs and the ones which require the most frequent and difficult types of decisions.

What really happens then in the perception, decision and reaction interface in this complex physiological structure, biochemical laboratory, and emotional mass we call man? The answer is not a very simple one. We must know considerably more about the role of heredity, early training, ego needs, motivation, intellectual capabilities, predilection for success, and reliability under specific stress conditions. We must know how these influences affect man's actions in response to machine environment stimuli. In other words, what I am really expressing is the need for a total systems study of the man/machine environment complex.

It has been stated that man has been studied for years and that we have a fairly good understanding of him, that he is really the known quantity in the system complex, that we are aware of his limitations, that basically man won't change, and that it does not appear he will be artificially altered to enhance his capabilities within the near future. I feel this is an oversimplification and not entirely correct, for while we know a great deal about man's general physiology, we do not have as detailed knowledge about the intricate interactions of his systems, subsystems, and biochemical integrations. Certainly, we should provide design engineers with as much positive knowledge as we have available today concerning man's capabilities and limitations and encourage them to design to known human criteria. Here, a basic decision must be made as to whether to design to more limited capabilities of the least able pilot or whether to design for the pilot with average abilities. It is important also to indoctrinate the pilot with this knowledge so that he recognizes and understands his limitations and avoids overconfidence and complacency. And, finally, I believe it desirable that this information be widely disseminated to supervisory, operational, and command personnel; for, if they are to effectively exercise their prerogatives, they must have a basic understanding of the pilot's needs and capabilities.

—Excerpted from "The State of the Art of Human Factors in Aviation Safety," presented at the 1965 Aviation Contractors' Safety Representatives Conference

Through careful study of past performance the pro learns how best to face the opposition. What's good for one, is trouble for another. But in baseball, as in naval aviation, the season performance separates the men from the boys.. in other words,

'Class Always Tells'

Quarterly Maintenance Error Report

Ralph Houk, manager of the Yankees, says "Class always tells," and he doesn't worry too much about the performance of the real pros on the team. He knows that during the course of a season they always come within a few percentage points of their normal batting and fielding averages after a slow spring start. Sometimes they're over, sometimes they're under. One thing certain, if a pro is under he is quick to analyze his performance to find out what he's doing wrong and why, so that he can correct his ways.

The pros of aircraft maintenance are those who perform countless maintenance actions flawlessly, day in and day out, all "season" in all kinds of environments—no rain checks in this league—and often under less-than-best conditions. Here too, class always tells. These people are among the league leaders—they're league leaders because they study past performances and keep alert for possible weaknesses which lead to errors.

This is the reasoning behind this report. The "league" experienced 141 errors in the second quarter of fiscal '66; 3 of them resulted in *strikes*—an A-4, F-9 and a C-47—costing us $1,344,000. A Bravo-damaged A-4 cost us an additional $75,000. The 137 other errors cost us $287,290 for a grand total of $1,706,290. Of course, these figures represent only the *direct* costs. Add to this the cost of wasted man-hours, loss of mission-readiness, shipping, salvage and other hidden costs. It doesn't take a statistician to realize we need improvements in our batting and fielding averages—*now!*

Table I shows the distribution of our losses by model aircraft. Table II shows the distribution of errors by ratings and by model aircraft. Before you head for the showers, study the briefs that follow—there are several lessons in them for every maintenance man. Like the man behind the plate says, *play ball!*

Continued

TABLE I

Damage and Cost

A—Strike
B—Overhaul
C—Substantial
D—Minor
E—Limited

A-1	C	$ 11,250.00	E-1	E	1,170.00
	E	1,350.00	E-2	E	5,870.00
A-3	E	3,000.00	S-2	D	28,200.00
A-4	A	781,000.00		E	3,820.00
	B	75,000.00	P-2	C	45,500.00
	D	9,500.00		E	3,220.00
	E	8,700.00	P-3	E	20,400.00
A-5	E	10,000.00	H-2	E	3,040.00
A-6	E	5,000.00	H-3	E	8,660.00
F-4	E	54,500.00	H-34	D	8,200.00
F-8	D	16,000.00		E	2,820.00
	E	12,900.00	H-46	E	3,290.00
T-1	E	600.00	C-45	C	8,750.00
T-2	E	600.00	C-47	A	165,000.00
F-9	A	398,000.00	C-54	E	2,400.00
	E	1,000.00	C-117	E	1,200.00
F-10	E	750.00	C-121	E	1,450.00
T-28	E	450.00	C-130	E	3,700.00

Total: $1,706,290.00

TABLE II

Maintenance Errors by Rating and by Aircraft

Aircraft	Rating AD	AM	AT	AE	AO	Totals By Aircraft
A-1		1			3	4
A-3	1					1
A-4	3	5	1		18	27
A-5	1	3				4
A-6		1			1	2
F-4	3	9	1	2	2	17
F-8	2	5		2	2	11
T-1		1				1
T-2		1				1
F-9	2	2		1		5
F-10		1				1
F-11	1					1
T-28	1	1				2
E-1	1	1				2
E-2		1				1
S-2	5	6				11
P-2	4	6				10
P-3	10	4		1		15
H-2	1	2				3
H-3		4				4
H-34	2	4				6
H-37					1	1
H-46		1				1
C-45		1				1
C-47		1				1
C-54	1	1				2
C-117		2				2
C-121	1	1				2
C-130		1				1
C-131	1					1
TOTAL	40	66	2	6	27	141

AT

F-4B While attempting to close a canopy at night with no lights an Avionics man actuated the canopy jettison handle instead of the normal canopy close handle and jettisoned the canopy. The safety pin had not been installed in the canopy jettison system.

A-4E The aircraft was ready for taxi to the turnup area. Due to inability to receive taxi instructions, a radioman handed the crew chief a new headset. The attached oxygen mask dropped from the headset and was ingested into the engine. Failure to utilize access ladder and turn up screens resulted in FOD to engine from loose gear handled by the crew.

AE

P-3A The No. 3 engine fire warning light came ON and the engine was secured. Investigation disclosed that a length of lock wire had been left on the engine lying across the tail pipe and a fire warning element.

TF-9J During landing the aircraft stalled and spun into the water. Investigation revealed that the aircraft had a recurring angle-of-attack discrepancy. It was further determined that the vernier calibration set into the angle-of-attack transmitter was well outside the normal operating range.

RF-8A Installation of the improper speed brake override switch resulted in the speed brake being ground off during a landing.

F-4B Improper wing-up switch rigging caused the speed brake not to retract automatically when the landing gear was lowered.

F-4A During takeoff run the bus tie light came ON. The takeoff was aborted. On rollout the generator light came ON and the starboard engine flamed out. Investigation revealed bent pins A&B in plug 7 of the aircraft power control assembly.

F-4A With the SPC engaged the altimeter indicated 2500 ft instead of the actual 1400 ft. The airspeed indicated 250 kts with gear and flaps down and the angle of attack indicated 19.2 units. With the SPC disengaged proper readings were achieved. The wrong angle-of-attack probe had been installed in the CADC.

AME

F-4B The aft canopy dump valve was removed for servicing. The canopy was not tagged as inoperative. In order to wash the aircraft the canopy was closed. Following washing the pneumatic system was serviced and the aircraft turned up. When the canopy open position was selected to reinstall the valve, the canopy raised rapidly due to no back pressure, resulting in canopy damage.

F-4C & F-4B The forward canopy separated from the aircraft in flight. A 3000 psi pressure relief valve had been installed instead of the required 1280 psi valve. This, coupled with a pressure regulator failure, allowed extreme overpressure to shear the canopy pins.

F-4B The canopy jettisoned at 300 kts and 3000 ft. A landing was accomplished. The cabin pressure regulator valve was positioned midway between flight and test. The lock wire had not been put on tight enough to hold in one position.

A-6A During the servicing of the canopy jettison bottle the canopy was jettisoned. The ground safety pin had not been installed. Misrigging of the jettison controls allowed the actuation while attempting to properly seat the control valve lever.

RA-5C After removing the seat from the aircraft the shipping pins were not installed in the initiators. While performing routine maintenance the separation system initiator was inadvertently fired causing burning of the liners and fittings and rupture of the separation bladders.

AO

CH-37C Improper tightening of the sway braces resulted in the inadvertent dropping of an auxiliary fuel tank.

F-8D Failure to properly secure an ammunition can door and poor preflight of the aircraft resulted in the loss of the door during flight.

F-8E Failure to properly install and check for security resulted in a LAU-33 ZUNI launcher separating from the Aero 3A launcher on takeoff.

F-4B Failure to remove missiles, install safety pins or to disconnect the umbilical cord prior to performing electrical check resulted in the inadvertent firing of a missile.

F-4B Failure to check for the presence of safety pins or to disconnect the electrical leads prior to checking emergency stores release resulted in the jettison of a pylon and launchers on the flight deck.

A-6A Erroneous wiring of a MER harness power release cable and Aero 7A rack resulted in inadvertent release of a multiple ejection rack.

A-4E A TER rack separated from an MER rack located on center line station No. 3. The sway braces could not be properly snugged down. No ejection cartridge was installed in the MER rack.

A-4B Four Incidents Same Squadron. Failure to use the correct sway brace pressure and failure to install dowel pin in index hole of the bomb body resulted in the inadvertent release of bombs from each aircraft.

A-4C Failure to apply a no-voltage check prior to starting the aircraft resulted in an inadvertent jettison of the external fuel tank.

A-4E Failure to properly load/check a Mk 76 bomb mounted on an A/A 37 PMBR resulted in the store falling from the rack.

A-4E Failure to connect the primary lead, which supplies power to the ejector rack, to the missile launcher, resulted in the dropping of the launcher and missile when the pickle was pressed to test the shrike tone.

A-4C Failure to utilize the retracting dowel pin when carrying Mk 106 practice bombs resulted in one bomb falling from the rack on takeoff.

A-4C Failure to utilize the retracting dowel pin when carrying Mk 106 practice bombs resulted in two bombs falling from the rack shortly after takeoff.

A-4E Failure to properly check the mechanical operation of the Aero 20A-1 bomb rack resulted in a Mk-77 store breaking up when the forward hook would not open.

A-4E Failure to inspect the ejector foot for cleanliness, corrosion and proper functioning resulted in the foot sticking when a tank was dropped. The tank pitched up striking the leading edge of the wing.

A-4E Failure to remove a cartridge from an empty ejector rack resulted in the ejection of the ejector foot and damage to the aircraft.

A-4C Failure to check for the presence of cartridges in the ejector rack and failure to install safety pins resulted in the dropping of an external tank when the electrical connections were made.

Continued

A-4C Failure to check for the presence of cartridges or to install safety pins resulted in the dropping of an external tank during an ordnance electrical check.

A-4C Improper clearing of a gun after inspection for a jam resulted in one 20 MM round being fired and causing "B" damage to another aircraft.

A-4E Two different types of JATO bottles were installed. Upon takeoff the aircraft swerved uncontrollably and crashed.

EA-1E Using a screwdriver to release a drop tank instead of the manual release caused the release lever to bend creating an unsafe condition which permitted a tank to drop.

A-1J Improper tools were used previously to release a drop tank and the stirrup had been partially broken. The rack was only partially latched and the port tank was inadvertently dropped.

AM

KC-130 Failure to insure adequate clearance prior to maintenance and to properly ensure observers are aware of operations, resulted in damaged wing flaps.

C-121 During an engine change, maintenance personnel failed to install a tail stand. When a crewman walked aft inside the aircraft the plane settled causing rudder damage.

TC-117 After completion of a night flight, elevator battens were placed on the ailerons. Later on that day the flaps were lowered bending the flap ends.

TC-117 While the aircraft was being turned up for a maintenance check the hydraulic man started to check out the control system. He was not aware of the battens being installed and lowered the flaps bending both outer wing flaps on the outboard end.

C-54P During flight a piece of cowling from the No. 1 engine separated from the aircraft. It is suspected that the cowling, which had been removed the previous day, had not been fastened properly upon reinstallation.

LC-47H During landing and takeoff practice a portion of the port ski struck some packed snow just prior to liftoff. The forward limiting cable was torn from its fitting. Investigation disclosed that there had been improper attachment of the forward restraining cable with one U-bolt clip instead of a nicopress fitting.

UC-45J During a maintenance runup, the tail wheel was tied down but slack was left in the chain. Parking brakes were not set nor pedals depressed. As power was increased on the No. 1 engine the aircraft jumped the chocks. The sudden strain on the tie-down tore the tail wheel from the aircraft.

CH-46A During a blade unfold cycle by the maintenance crew, the control pawl interlock struck an improperly installed shear bolt causing the failure of the gear and absorber assembly which allowed one aft rotor blade to rotate downward and strike the ground. The shear bolt had been installed with the head down instead of up causing interference. *See Headmouse, "Bolt Installation Practice," page 23.*

UH-34E A cabin door separated in flight. Investigation disclosed that the emergency release handle had been partially activated prior to flight. The door traveled under the aircraft and up on the port side striking the stabilizer and tail rotor.

UH-34G Improper security of the port clam shell engine door resulted in its opening in flight at about 1200 ft. The door struck the port main strut but did not separate.

US-34J When removing blades from the blade saddle, the trailing edge of a blade was allowed to catch on the pylon inspection panel bolt heads.

UH-34D An inexperienced hydraulic man bled the rotor brake but failed to check the clearance on the brake pucks. During turnup, fire occurred due to the brake pucks dragging on the brake disc.

SH-3 During flight a noise was heard and the crewman discovered that the cabin door window had been lost. Investigation revealed that the loss was due to improper installation.

SH-3A Emergency exit window lost in flight. Most probable cause—window was not properly installed.

SH-3A The aircraft was being towed with the tail wheel locking pin partially engaged. The pin sheared and jammed between the support and the housing. When the aircraft was jacked the support assembly fell to the deck.

SH-3A With the aircraft flying straight and level the copilot's window separated and struck the port wing stub. Investigation revealed that a portion of the teflon track had been left out of the window guide track allowing excessive play in the window.

UH-2A During blade tracking of the main rotor blades a nylon flag was used rather than the acceptable canvas flag. On blade contact the flag was torn from the stanchion and the blades damaged by the grommets. The safety man was struck in the leg.

UH-2B The aircraft lifted off in an uncontrollable climbing 360-degree turn on engine runup. The

pilot regained control and made a roll-on landing using manual throttle. Investigation revealed misrigging of the main rotor blade flaps to minus 6 degrees instead of plus 6 degrees during main rotor blade replacement.

P-3A Two wheel assembly bolts sheared during aircraft tow. Investigation revealed the bolt failures were the result of improper installation.

P-3A During takeoff the starboard inboard tire failed. A wheel bolt had been left inside the tire during buildup.

P-3A When wing skin damage was noticed, investigation disclosed that a rivet bucking bar was wedged between the wing air control panel and the upper wing skin at wing station 219. Work had been performed in this area three weeks prior to the occurrence.

P-3A As the flaps were being lowered for maintenance the starboard flap struck the ladder railing on a maintenance platform buckling the flap upward. The ground safety man had not checked under the wing for proper clearance.

SP-2E On takeoff roll the pilot noted binding of the elevator control. Insufficient runway remained to abort. Upon becoming airborne the control became free. A screwdriver, electron tube shield and a rock were found in the elevator control system.

SP-2H Overtorque of the B-nut on the pressure transmitter line resulted in a cracked nut, hydraulic leak and securing of an engine.

SP-2H Hydraulic fluid was noted streaming from the starboard wheel well. The O-ring seal between an elbow and a union in the pressure transmitter had failed. Also, the wrong O-ring had been installed.

SP-2H Upon aircraft turnup without the normal braking system in operation due to the removal of the main system accumulator, the aircraft jumped the chocks and struck two other aircraft.

SP-2H An improperly fastened oil expansion tank access panel resulted in its loss in flight.

SP-2E A wing life raft and door jettisoned in flight. The release handle in navigator's compartment had been inadvertently actuated.

S-2D Radome failed in the down position. The radome actuating assembly fouled due caking of the lubricant. Improper lubricant had been used.

TS-2A Following takeoff, the pilot raised the landing gear and got an unsafe indication on the starboard main gear. The gear was lowered and the plane returned to base. Investigation revealed installation of an incorrect thermal relief valve allowing the landing gear to strike and hang up on the shrink link attaching plate.

S-2D Aircraft was jacked to replace the landing gear selector valve. When the work was finished and the aircraft was being lowered, the nose jack stuck. While attempting to fix the jack the starboard wing jack slipped from under the plane and damaged the wingfold area.

TS-2A During a test flight the port inboard leading edge assembly came loose and flipped to a vertical position. An uneventful landing was made. Investigation disclosed that this section of the leading edge had not been properly secured following maintenance.

TS-2A During a routine maintenance check for a hydraulic leak in the starboard wheel well, a portable hand pump was used to pressurize the up line from the landing gear snubber. After a few actuations, the nose gear collapsed. Investigation disclosed that no ground locks had been installed on the nose gear.

US-2B The wings were being spread to check the operation and to inspect for hydraulic leaks. During the spread the port wing locking pins went home before the wing reached the spread position damaging the wingfold area. Observers were not used during this operation.

E-2A As an aircraft was being jacked with the rotodome extended, the rotodome struck two chain fall mounting brackets puncturing the top skin. The supervisors failed to check the clearance prior to the operation.

E-1B Improper installation of the life raft resulted in its loss on a catapult shot.

T-28B Improper installation of the nose gear overcenter link caused the gear to collapse while being towed even though the ground lock pin was installed.

EF-10B Failure to properly secure the escape hatch resulted in its loss during flight.

AF-9 Pilot could not get any aft stick movement in flight. He made a straight-in power-controlled approach to a normal landing. Inspection of the elevator controls revealed a shrader valve adrift in the aircraft had lodged in the stick cable quadrant preventing any aft stick movement.

TF-9J The nose wheel fork assembly separated from the aircraft on takeoff. A landing was made on a foamed runway with the gear up and the speed brakes open into the midfield arresting gear. The nut plate and machine bolt had not been lock-wired.

T-2A Canopy separated in flight. Canopy maintenance prior to flight was not checked for completeness prior to sign-off. The manual release had not been fully engaged.

T-1A The upper engine access door was lost in flight. Five days earlier a pin designed to hold the door was missing and had been replaced but not safetied. The door came off at 1.5 G.

Continued

F-8A The main landing gear tires had been serviced for carrier operations. Leakage on the tire side of the gage allowed an erroneous reading. The port tire was serviced to between 600 and 700 pounds instead of the required 400. As the aircraft was being refueled the tire exploded causing injury to personnel. Tire pressure had not been checked after servicing.

F-8E Improper security resulted in the loss of a panel during lift off.

F-8E During a wing inspection of inflight damage, the right-hand aileron was raised. Following the inspection the wing was folded without neutralizing the aileron resulting in the wing being damaged.

F-8A Port equipment access door separated in flight due to improper security and inspection. Tempo of operations was reported as a contributing factor.

F-8D During pressure refueling, using all proper procedures, an elastic stop nut, which had been left in the fueling manifold at some previous time, lodged in the fuel shut off valve preventing the valve from functioning.

F-4B The aircraft pitched nose-down during a test flight at 10,000 ft. Recovery was made at 8000 ft. The aircraft could only be controlled by the use of AFC modes. An approach and landing were made at 180 kts with flaps up and abort gear. Investigation disclosed that a screwdriver was lodged in the stabilator trim actuator.

F-4B Following a Condition I CAP with the canopy closed, the RIO selected canopy OPEN. The canopy opened about one foot and then jettisoned. The canopy had been closed with the seat safety pin bag laying across the top of the seat. The pin bag or a streamer caught on the jettison handle or linkage while the canopy was opening.

F-4B During a preflight inspection the mechanic noted that the aft canopy safety strut was installed. He entered the rear cockpit and claims to have put the canopy control in OPEN prior to attempting to remove the strut. Subsequent to removal of the bal-lock pin, he pulled the strut from its position around the actuator piston. After only a slight movement the strut popped out striking the rear of the seat bending the torque assembly and breaking the banana link assembly. The catapult firing sear pin was bent and cracked. The strut poked a hole in the canopy while closing and gave the mechanic a rap on the head. It is suspected that he placed the canopy controls in closed position while facing aft.

F-4B Failure to install ground locks and improper drop-checking procedures resulted in the collapse of the landing gear as the aircraft was being moved from the maintenance area.

RF-4B Failure to tag an inoperative canopy pneumatic system resulted in its inadvertent operation and damage to the adjacent structure.

RA-5C On postflight inspection a severe hydraulic leak was noted around the flap actuator piston shaft. The seal and back-up ring were noted to be scored and crimped. The barrel inner lap surface at the cap end was scored. The DIR revealed that on assembly of the cylinder the teflon back-up ring had rolled out of the O-ring groove and had jammed between lands of the end cap and sealing surface of the barrel.

RA-5C During flight a Marmon clamp failed on a bleed air line burning the No. 2 hydraulic system lines. A precautionary landing was made. Investigation revealed that the clamp failed due to the clamp nut being stripped due to overtorque.

A-4E The aircraft landed at destination with both main gear tires blown and the nose tire cut. The three wheels were changed. Upon returning to the home station, damage to the port wheel, brake, nose wheel and associated parts were noted. The port main landing gear wheel bearing had not been installed and both nose gear bearings were on the same side of the wheel.

A-4E During flight the intake duct vane assembly broke from the aircraft. The forward anchor nut failed allowing the vane to turn and tear from the fuselage. The failure was due to fatigue as a result of improper torque.

A-4B When the gear handle was lowered for a landing, the left gear hung up in the wheel well. A wheels-up landing on drop tanks and a foamed runway resulted in minimum damage. The DIR revealed that the strut had just been serviced and was full of oil but there was no air. The strut would not extend and had hung up in the wheel well.

A-4B During flight the left hand main landing gear would extend only about 10 inches and would not extend further nor retract. A landing was made on the drop tanks on a foamed runway. The strut contained no air, would not extend and had hung up in the wheel well.

A-4C On a test hop following installation of AFC 303 and 269 the starboard main landing gear would not extend more than 12 inches out of the well with the forward door fully open. An intentional wheels-up landing was made. The DIR revealed that there were no material defects. The strut had been serviced only with oil and no air.

A-4E The aft section of the fuselage was mounted near one end of a 3100A stand for easy access during a modification. When personnel climbed on the stand the stand tipped, damaging the lower lip of the

tail section.

EA-1E On takeoff the port rear canopy came open and banged against the starboard canopy. Investigation revealed that .020 copper seal wire had been used instead of the required .032 wire to secure the linkage. The weaker wire failed allowing the canopy to open.

A-1H After a 20 MM gun had been removed the wing was spread. A tool left in the wingfold area jammed the wingfold mechanism and damaged the spar.

AD

NC-121 During climbout a power loss occurred on the No. 2 engine. The front plug of the No. 17 cylinder had backed out due to improper torque.

C-131F A loss of BMEP occurred on the starboard engine and the analyzer revealed a dead cylinder. An oil leak and smoke appeared and the engine was secured. DIR revealed failure of the cylinder holddown studs due to improper torque of the palnuts, which allowed the cylinder holddown nuts to become loose.

C-54Q During a post-maintenance test flight the cowling on the No. 1 engine came loose and struck the propeller blades. The antidrag ring toggle was loose due to improper rigging during maintenance.

UH-34D Power was lost in flight and immediately regained. Troubleshooting and a spark plug change was accomplished with negative results. A takeoff was again attempted. The engine again backfired. A second inspection revealed that the ignition lead to the No. 6 cylinder had been installed with only one thread holding and vibration would break the circuit.

UH-34D After takeoff and during the climb a popping sound was heard from the engine. The rubber insulating sleeve terminal at the cylinder end of the high tension lead between the spark plug and coil on the No. 2 cylinder was split. The split was a result of improper installation.

UH-2A Failure to completely incorporate Interim Airframe Change 104 resulted in an engine start with the oil shut off valve closed and a flameout.

P-3A During flight the No. 1 prop light for No. 2 engine came ON. The engine was secured. The oil cap came off due to improper security.

P-3A (3) During flight, oil was noticed streaming from the No. 2 engine. Engine was secured and landing made. The tank to gear case oil hose was cracked and also the internal ring of the safety coupling had not been installed, allowing the safety coupling housing to move ½-inch allowing the O-ring seal to split and to be thrown out of the housing. *(3 cases)*

P-3A Improper rigging of prop controls following a prop change resulted in RPM fluctuation during feathering operation. The prop control rig plate was slightly out of position.

P-3A Improper installation of the prop filler cap locking pin resulted in oil loss and inflight securing of an engine.

P-3A (2) Improper security of prop reservior filler cap resulted in loss of fluid and in flight shutdown. *(2 cases)*

P-3A On a maintenance turnup, the afterbody cover of the No. 4 prop came off and damaged the prop blades. The cover had not been properly secured.

P-3A Aircraft was taxied up to the hangar for work on a brake discrepancy. No chocks were used. As the parking brake was released the aircraft rolled into a tractor which was being used as a work platform. The No. 3 prop was damaged.

SP-2H A fire occurred in the port jet between the tail cone and the fairings immediately after takeoff on a test flight. The oil filler cap had vibrated off due to a missing lock snap ring. Inspection of other squadron aircraft revealed 15 broken or missing snap rings.

SP-2H An oil leak was noted during flight. The engine was secured and a landing made. The rear oil scavenge strainer had been cross-threaded, not lockwired during maintenance, and had come out in flight.

SP-2H While troubleshooting an engine which had repeatedly backfired in flight and finding nicks in the No. 3 PRT, an AD ran the engine for 30 seconds. More backfiring and vibrations were encountered. Inspection revealed that large chunks of No. 17 cylinder were driven out of the No. 3 PRT. This procedure was in contradiction to GREB 212.

SP-2H An oil leak was noted on the starboard engine during a normal flight. The oil quantity gage indicated a rapid loss of oil. Engine was secured and landing made. Inspection revealed that the strainer cover had come off. Maintenance personnel had failed to lock-wire the plate after completing a special inspection the previous day.

S-2D A pilot was unable to change power settings with the throttle inflight. The mixture control could not be moved when an attempt was made to secure the engine. Investigation revealed that the nut and bolt which attach the throttle linkage to the carburetor were adrift in the accessory section. The

S-2D Failure to torque the adjusting screw lock after setting valve clearance resulted in valve failure in the No. 1 cylinder.

S-2E During flight a loud bang was heard and the T/P dropped to 40 psi on the port engine. RPM and oil pressure were fluctuating. The prop was feathered and a landing made. The carburetor air duct plug had not been removed and was lodged below the alternate air door shutting off the carburetor air supply.

S-2D During a landing approach after completion of the check off list, the No. 2 engine manifold pressure increased from 28 to 42 inches with no throttle adjustment. Inspection revealed that the throttle rod was disconnected. A discrepancy which required removal of the rod had been worked off just prior to the occurrence. No inspection had been made.

S-2E Immediately following reduction of power just prior to landing a fire occurred in the port engine accessory section. Inspection revealed that the B-nut on the main fuel supply line had been installed only finger-tight during a carburetor change. This caused a fire in the accessory section. *See "Guessing Game", page 17—Ed.*

E-1B A complete power loss was encountered in flight on the starboard engine. Investigation disclosed that the magneto lead had become disconnected due to the noninstallation of the lockwire.

T-2B During flight the throttle rod became disconnected. Engine was secured at 2500 ft and a landing made. The lock nut holding the assembly had backed off. It was suspected that either the nut had not been torqued or a bad nut was used.

F-11A During flight the engine oil pressure dropped to 10 psi for two minutes and then dropped to zero for the remaining five minutes of flight. A precautionary approach and landing was made. The gasket on the afterburner oil filter cap had failed due to overtorque of the cap.

TF-9 Failure to inspect and adjust the front idle detent in the throttle quadrant resulted in an inadvertent shutdown of the engine during touch-and-go landings.

AF-9 Tail section fell off the tail stand. The forward attaching bracket had not been secured.

F-8C Failure to remove the intake cover resulted in its ingestion during a ground runup.

F-8D During a turnup for trimming a fire developed in the tail section. Investigation revealed that the fuel vent line was leaking at the tail break coupling. The gasket revealed metal to metal contact through 90 degrees of the circumference indicating that the coupling had not formed a seal since tail installation.

F-4B During flight an attempt to light off the starboard afterburner proved unsuccessful. The starboard nozzle was observed to be full open and the oil pressure was at zero. The engine was secured and a landing made. The No. 3 oil scavenge return line B-nut had backed off resulting in an oil leak and complete loss of oil from the tank. Failure was caused by improper torque.

F-4B Prior to turn up, the angle of attack probe cover was removed and placed on top of a starting unit which was parked. As the engine was started the cover was picked up and drawn into the intake duct resulting in damage to all of the compressor stages.

F-4B Immediately after an afterburner catapult launch as afterburner was deselected the left engine fire warning light came ON. The light remained on after the throttle was retarded to idle. The engine was secured and single engine landing made. Investigation disclosed improper incorporation of J-79 PPC 80 the torch ignitor valve outlet hose had chafed through allowing fuel to leak and a fire to occur.

RA-5C During flight the engine oil pressure dropped to zero with a loss of nozzle control. Investigation disclosed that bolt, PN 313P10U had been installed with the bolt head forward resulting in insufficient clearance between the bolt and the No. 3 sump scavenge oil line. Chafing of the bolt against the line resulted in tube wall rupture and the loss of oil.

A-4B During flight the oil flip-flop gage went to OUT and the oil pressure indicator began fluctuating between 0-and 20 psi. The aircraft diverted to an emergency field and a landing was accomplished. Though there were no oil leaks found it required 13 quarts of oil to properly service the system indicating poor servicing prior to flight.

A-4E During flight the oil pressure dropped to 10 pounds just prior to shutdown. Investigation disclosed that an oil line had been locally fabricated and though the B-nut was tight, the line was not the correct length and would not mate properly.

A-4E During shutdown fuel was noted streaming from the aircraft. Investigation disclosed a broken tube assembly near the upper B-nut fitting. It was suspected that a fatigue failure induced by tool marks on the nut due to improper maintenance had caused the failure.

A-3B During a ground runup, as the engine was started, the aircraft jumped the chocks. Failure to connect the fuel control linkage resulted in the engine going to 95% before the engine could be shutdown. The aircraft rammed a parked ground vehicle.

The Case for Tech Pubs

By LCDR C. C. Witkowski
OinC, Det 85, HC-4

It is firmly believed that the person, system or procedure which will solve the widespread, age-old problem of getting technicians and especially the mechs (ADs and AMs) to follow the simple steps in HMIs and Maintenance Requirement Cards (MRCs) to do maintenance work and servicing will have done the most to reduce Maintenance Error.

Unless and until this specific problem is solved to a reasonable degree whereby "play it by ear" type of maintenance is eliminated, maintenance error will continue to prevail at unacceptable rates. This conviction stems from eight continuous years in the maintenance programs of various air stations and squadrons. What is not realized is that the written procedures in the various pubs and MRCs have Quality Control automatically built-in for the user.

Although many cases of noncompliance with written maintenance procedures can be cited, a recent instance occurring in the helo detachment aboard ship spotlights the gravity of the simple phrase, "failure to comply."

A 30-hour Special Maintenance Requirements check of the four fuel filters was completed on our UH-2 helicopter. Subsequently, we began to experience a series of filter fuel leaks on two of the filters. On checking the 30-hour MRCs and questioning the mech involved, the following items were uncovered on the 'Static Fuel Filter' installation:

- The mech did not use the MRCs as required.
- He was not aware that O-ring seals were installed in the filter.
- That prescribed (and critical) cleaning of filters was involved.
- That replacement of O-ring seals was required.
- That torquing to a prescribed value was stipulated.
- The filter was lock-wired backwards.

On the more critical Fuel Control Filter leaks (two), a repeat of MRC noncompliance was detected . . . and in this instance the situation had immediate and serious ramifications in that the mech had:

Attempted to stop the initial leak by adding torque to the filter body.

▶ Had not replaced O-rings initially on the first fuel leak.

▶ Had twisted the filter, thereby cutting the O-ring seal on removal despite a MRC caution note requiring the filter to be "pulled straight out *to prevent fuel contamination from damaged O-rings.*"

▶ Had not lubricated O-rings with petrolatum as prescribed in the MRC.

Due to the critical nature of jet engine fuel pasages, we were faced with either removal of the Fuel Control unit for possible contamination or an engine change if the unit was not available. But, since the helo had been flown 3.5 hours before uncovering the discrepancy it was concluded that cut pieces of the O-ring seal had been washed out vice ingested into the fuel control. Further inspection of the downstream filter lent credence to this premise.

A million-dollar helicopter and personnel could easily have been lost due to this failure to comply with simple maintenance servicing requirements spelled out in the MRC deck. All of the foregoing occurred after repeated briefings on the procedures and requirements for using the applicable technical reference for doing maintenance work.

An appropriate question for any maintenance officer on a continuing basis is: do your people follow the steps spelled out in present MRC decks and HMIs . . . and equally important, are your supervisors ensuring that they do?

As a solution to the overall problem, it is recommended that a professional, comprehensive indoctrination be accomplished in the knowledge and working use of aeronautical technical publications (and related MRCs/HIRs). This should be done in "A" and "B" technical schools and continued properly into the shore station/squadron levels.

Emphasis and training is required comparable to that given the recently adopted 3-M System, which hopefully will cover the end result of good maintenance completed. It should be noted that one or two lectures or articles on the subject have not been the solution to date. Increasing coverage of the subject in semiannual rating examinations (and publicizing same) should do much to create immediate interest Navywide in this vital subject. How can we afford to do less?

NOTES AND COMMENTS ON MAINTENANCE

Packaging for Air Transport

NAVWEPS 15-03-500 is the manual for *packaging and handling of dangerous materials for transportation by military aircraft.* This manual provides instructions for the preparation of explosives and other dangerous materials for shipment by military aircraft. These instructions are intended to assure that such materials, when offered for shipment, are packed, marked, labeled, and in proper condition for transportation. The instructions provided in this manual are applicable to the preparation and shipment by the Departments of the Army, Navy, and Air Force of explosives and other dangerous materials except Special Weapons, which are Hazardous Cargo.

IF . . .

IF you maintained your car as airliners are maintained—

You'd hire three full-time mechanics

You'd make a "walk-around" inspection before every drive—even to the shopping center around the corner

You'd buy four new tires every 500 miles

You'd tune the engine every 2500 miles

You'd take most of the engine apart for inspection, change the brake linings and take the transmission apart every 10,000 miles

You'd order a new engine installed at the end of 25,000 miles

You'd get a complete physical checkup every six months

—Skylines

Why Report? Why Report? Why Report?

Attention can *only* be given those mechanical conditions or operational problems which have been reported to exist.

Unless using activities support the need for changes, the changes will never materialize. Report, by UR, Flight Safety AmpFUR, or aircraft incident report or even Anymouse, but *regardless* of how, *report it.*

110 Volts Can Kill

IT depends on how much current passes through your body. And that depends on voltage and resistance.

Example: Take a 110 volt drill. Say the metal case becomes electrically charged. Both hands are wet. Resistance is then between 2720—930 ohms. The current is then 40—118 milliamps. You're dead. How'd you figure that?

Current = $\frac{\text{Voltage}}{\text{Resistance}}$ = $\frac{110}{2720}$ = .040 amps

Between dry hands the resistance is between 18,000—6,600 ohms.

$\frac{110}{18{,}000}$ and $\frac{110}{6{,}600}$ = 6 & 17 thousandths of an ampere

Not enough to kill.

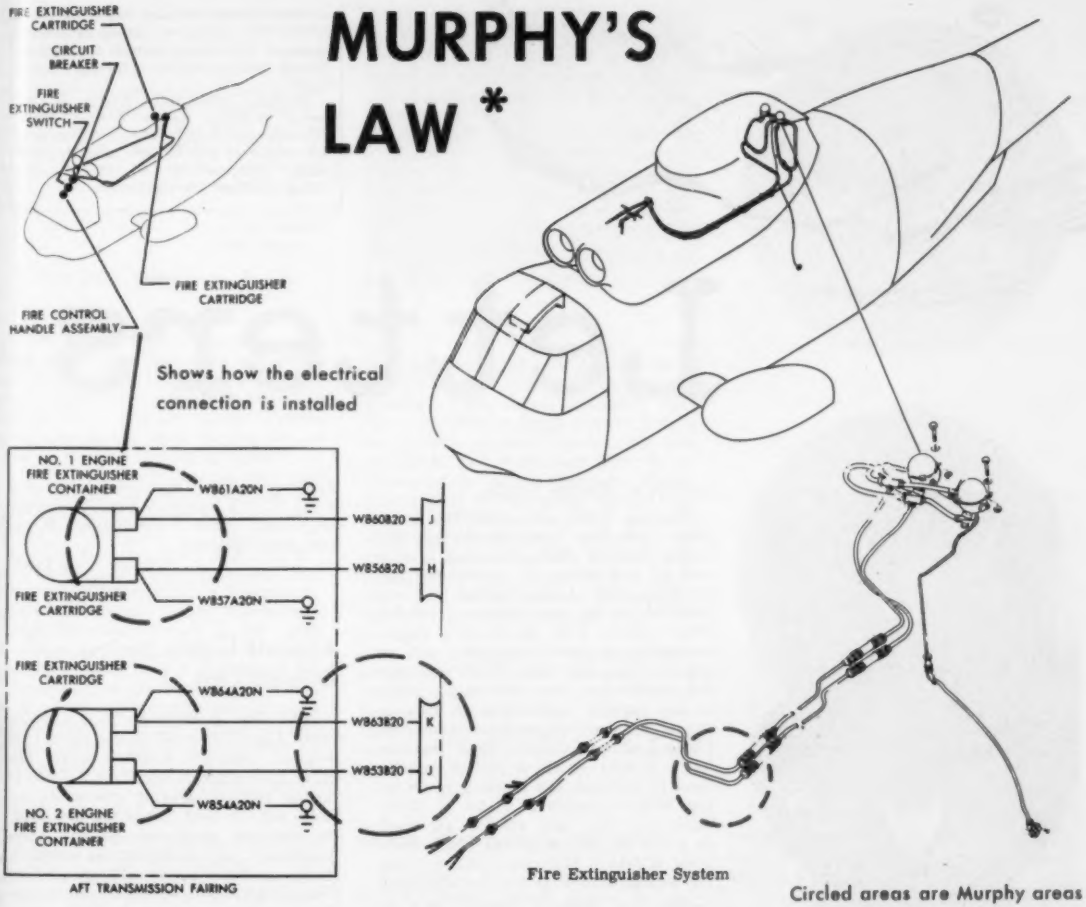
Lesson 1 for survival: keep hands (and feet) dry when handling electrical appliances, tools, etc.

How come two figures for resistance? Resistance varies from person to person, and even from one day to the next. A cut or burn can lower resistance to 200 ohms!

Lesson 2: Electricity, like water, finds the easiest path. Therefore, provide a path for electricity easier than the one through your body: see that the metal case on appliances, etc., is connected by a third wire to the ground.

—Safety & Health

MURPHY'S LAW *



Fire Extinguisher System

Circled areas are Murphy areas

A quality control inspector who was investigating the engine fire extinguisher system of an SH-3A, discovered that the main and reserve discharge cartridges had been cross-connected to the two turboshaft engines. Further research of the system revealed:

- Variations in methods of wiring between the Maintenance Requirement Card (MRC) Deck and the Helicopter Maintenance Instruction (HMI).
- Probability of inadvertent cross-connection of tubing through which the extinguishing agent discharges because of similarities of lengths of tubing, color coding of wiring, and absence of graphical descriptions.
- The effect of these discrepancies would be to permit discharge of the extinguishing agent into the engine opposite from that selected by the pilot-actuated T-handle in the event of engine fire, i.e. the good engine.

These discrepancies were subsequently found to exist in numerous SH-3 aircraft in both Atlantic and Pacific Fleets.

As a result of the report of this discrepancy, BuWeps issued intermediate Airframe Bulletin 76 and instituted a Navy-wide change in Calendar Inspection MRC.

The inspector in this case was Frederick C. Kaufman, AEI of HS-1. He was cited for meritorious performance of duty by Commander Naval Air Force, Atlantic Fleet.

*** If an aircraft part can be installed incorrectly, someone will install it that way!**

APPROACH welcomes letters from its readers. All letters should be signed though names will be withheld on request.

Address: APPROACH Editor, U. S. Naval Aviation Safety Center, NAS Norfolk, Va. 23511. Views expressed are those of the writers and do not imply endorsement by the U. S. Naval Aviation Safety Center.

Letters

Survival Knife Plate

Miramar, Calif.—Our squadron parachute loft has been modifying the leather survival knife case that is carried by our pilots. A recent ejection forced a knife blade through an unmodified leather case causing a painful minor injury. This modification might be useful to other squadrons and is passed along herewith. Photo 1 shows the method used for attaching the knife to the survival vest which in turn is attached to the integrated torso harness. Photo 2 shows a closer view of the case itself. A metal shield is placed on both sides of the case. The shield is made using 2024T3 aluminum sheet of .050" thickness. The two shields are held in place by ⅛" universal head rivets (AN 470-A4). The rivets pass through the leather as well as the two aluminum plates. The knife is thereby held in place during ejection.

J. M. SCHULZE, JR., LCDR
ASO, LIGHT PHOTORON 63

Photo 1

Photo 2

• Your idea for a reinforced knife case seems to be excellent although not new. The SV-2 survival vest which is forthcoming will have a fabric pocket for the knife case.

Command Attention

NAS Norfolk—Congratulations to Cdr. Ralph M. Tucker, C.O. of VS-34 for his truly professional safety article, "Command Attention," which appeared in the April issue of APPROACH.

His four points of (1) creating a safety conscious command climate, (2) training and evaluation of pilots, (3) reduction of maintenance error and (4) responsible reporting are the synthesis of squadron aviation safety.

I discussed this safety article in detail at one of our squadron All Pilots' Meetings and also inserted a copy of it in my "C.O.'s Turnover File." I wonder how many other commanding officers have done likewise.

DONALD J. DE BAETS
C.O., VRC-40

Aircraft Lights During Ground Ops

FPO, San Francisco—"Red Light—Green Light" on p. 47 of the April 1966 issue of APPROACH struck a nerve. The quote from OpNav P3710.7B, "Pilots of taxiing aircraft sighting emergency vehicles on the field displaying the flashing red light, shall stop and hold their positions . . . ." is the crucial sentence. During a 1963-65 tour aboard an East Coast NAS I had an intermittent low-pitch running battle with NAS operations over their practice of using the red flashing lights on crash vehicles *at all times* when they were on the field. They stated that it was common practice everywhere, and that it made identification of the emergency equipment easier, and that they saw no reason to desist. I have not seen this procedure used elsewhere, and was rather confused the first time I encountered it.

Then one dark night I was on a practice PAR final with a new pilot in the left seat when I observed a small green light ahead which maintained a constant bearing and a red flashing light just to one side which began diverging rapidly from the green one as we continued inbound. Immediately sensing an impending midair collision, I took the aircraft from the other pilot, and we took violent evasive action at low altitude and airspeed. Subsequent investigation revealed both lights were on the ground, and the red one belonged to one of the good old crash trucks, who was just changing his location on

the field. There was no emergency in progress, as usual.

A written statement of the incident and oral protests to the RATTC officer and ODO immediately following produced no results, and I departed the station several months later for my present duty. Something oughta be done! Let's get standardized on the use of flashing red lights on emergency vehicles.

L. E. GOEWEY
LCDR VP-40

• **See next letter.**

NAS North Island—Regarding the letter in the May 1966 issue concerning use of aircraft lights during night ground operations, paragraph 901b.5 of OpNav Inst. 3710.7B states "Ashore, navigation lights shall be turned on prior to starting engines at night."

The C-54 NATOPS manual even goes a step further by noting that the taxi light will be turned on during engine runup.

While I can't place my finger on it I recall something several years ago that said if the aircraft rotating beacon was turned on during ground operations, it could be confused with the red lights on emergency vehicles. As a matter of fact, the DP-2Es in this squadron have a microswitch on the landing gear which prevents normal operation of the anticollision light until the aircraft is airborne. I hope these few points will be of assistance.

R. O. DURYEA, LT
FLIGHT OFFICER, VC-8

• The rotating beacon, anticollision light or Grimes light, whichever you prefer to call it, is apparently not considered in the same category with navigation lights, according to OpNav 3710.7C. Paragraph 549b of this instruction states that "When installed, the anticollision light will be used from takeoff until landing during all flights." This seems to imply that the anticollision light should not be on during ground operations, but should be activated just prior to or immediately after takeoff. Paragraph 623f of the same instruction states, "Pilots of taxiing aircraft sighting emergency vehicles on the field displaying the flashing red light, shall stop and hold their position until authorized to proceed by radio or by light signals from the tower."

It isn't hard to imagine how easily an activated beacon on a taxiing aircraft at night could throw in a confusion factor, not only to other pilots on the field, but to tower and emergency vehicle crews as well.

Has information in any Safety Center publication ever helped you to prevent an accident, avert an injury, or deal with an emergency in a better way?

If so, and you have not already informed the Safety Center, it is particularly desired and important that you do so. Such feedback is vital to all departments at the Center and for fiscal support of our safety research and education programs.

Front and rear views of ditch heading computer

Ditch Heading Computer

Washington D.C.—After reading the article "Stuck Throttle Bingo" in the March 1966 issue of APPROACH, I wonder if the ship in question completed and forwarded to the pilot the recommended ditch heading for his locale. In this instance the ditching was most successful, but—what if wind, sea and weather conditions were not so favorable?

I suggested if this recommended ditch heading had not been provided to the pilot by Air Ops or PriFly, they should be able to do so. Ocean Station vessels compute a new recommended ditch heading each hour by use of a small ditch heading computer (see photos above).

Minimum recommended allowance is one per ship! It may be handy for transoceanic aircraft—just in case. It weighs less than an E-6B.

C. E. BROWN, JR., LCDR
U. S. COAST GUARD HEADQUARTERS

• This computer, which is 7½ inches in diameter, may be ordered as follows:

Computer, Ditch Heading
Mil Spec—C-23261 (CG)
CG 6605-064-6369
Stock Point: CG Supply Center Brooklyn
31st street and 3rd avenue
Brooklyn, N.Y. 11232

Cost of computer ($14.20) would be chargeable against unit Bravo allotment.

Superintendent of Documents
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Vol 12 **approach** No 1

Our product is safety, our process is education and our profit is measured in the preservation of lives and equipment and increased mission readiness.

Contents

1 Strike One, You're Out
By LCDR R. E. Post

5 Spot The Hazard

6 The New Boss

8 RAWS
By LCDR J. B. McDaniel

14 Operations Safety Symposium
By LTJG S. G. Gross

17 Guessing Game

24 Underwater Ejection

29 Survival Field Test

30 So Who You Kidding, Tiger?
By LT R. E. Atkins, MC

31 Sea Survival

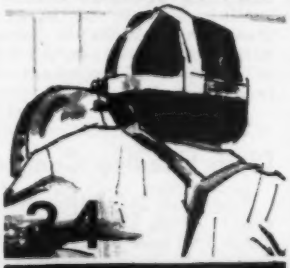
48 33 Man Machine Complex
By C. I. Barron, MD

34 Class Always Tells

43 The Case for Tech Pubs
By LCDR C. E. Witkowski

DEPARTMENTS

16 Short Snorts
20 Anymouse
22 Headmouse
32 Flight Surgeons' Notes
44 Maintenance Notes
45 Murphy's Law
46 Letters
IBC Lift and Drag



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Only Change is Permanent

We frequently hear it said: "When we get through this emergency, or this crash program, or this special situation, things will settle down and we can get back to normal." Many of us have longed for a stable state. To yearn for normalcy is certainly "normal."

However, the history of the Navy has been one of continued change. This change throughout our history simply parallels the changes which have taken place throughout the world—changes in all aspects of civilization: scientific, technological, and sociological.

It is plain to see that not only is change here to stay but the rate of change is increasing. It is well recognized that the rate of change throughout the world, in all of civilization, down through the ages, has been steadily increasing. It has been said that scientific and technological changes in the world are increasing at a rate which is proportional to Time raised to a power—at an experimental rate!

It is essential, therefore, that we recognize this ever increasing rate of change in the world about us in order that we may continue to effectively meet the needs of the modern society which we serve. Many of our present day methods, procedures, and equipment will not adequately meet the needs of tomorrow.

Consequently, we must place a high premium on creativity. Relying only on experience as a basis for solving our problems will become less effective as the rate of change in this world increases. If we are to meet the needs of tomorrow, we must encourage imaginative, creative thinking. In times like these, creative imagination can be of equal importance with time-honored experience.

—Adapted from the "Engineer's Digest," USCG

LIFT and DRAG

52879
MARINES